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**VIRTUAL REALITY APPLICATION
FOR HYPERMARKET**

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ABSTRACT

In these early years of 21st century, information technology is playing an important role in our lives. With the explosion of knowledge and information nowadays, Information Technology must be adopted to better manage of these aspect especially to increase the quality of virtual reality application.. And this is why Virtual reality (VR) application for hypermarket comes in to bring a better experience in lecturing.

Basically, "Virtual reality (VR) application for hypermarket" is application that can let user real-time interact with the system by the way in 3D. Therefore, user not only can get the information by word; user also can simulation navigate the virtual hypermarket environment. This VR system is creating by include user friendly concept for user easy to use, so is suitable for all level of people. This VR system provide many function to user, such as, user can stimulatingly travel around the virtual hypermarket environment, get a certain product price and location at this system without going to find at the hypermarket by themselves. Definitely you can buy your things and add into the shopping cart like the common e-commerce site! Beside this, the hypermarket administrator of this system can update and edit the database for stock maintenance. Just an authorize people can access this function for security method.

With the application, user can navigate the virtual environment in the way of 3D. This "Virtual reality (VR) application for hypermarket" is more interactive and brings more effectiveness compare to a traditional e-commerce site.

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CHAPTER 1: INTRODUCTION

1.1 OVERVIEW

Virtual reality (VR) application for hypermarket can be define as multimedia system which can install at computer that provides guidance and information to user though a virtual hypermarket space. The purpose of this application is for simulation and communication. It is designed and developed with 3D environment include with VR technology to make it more interactive and effective.

Therefore, user not only can get the information by word; user also can simulation navigate the virtual hypermarket environment. This VR system is creating by include user friendly concept for user easy to use, so is suitable for all level of people. This VR system provide many function to user, such as, user can stimulatingly travel around the virtual hypermarket environment, get a certain product price and location at this system without going to find at the hypermarket by themselves.

Beside this, the hypermarket administrator of this system can update and edit the database for stock maintenance. Just an authorize people can access this function for security method.

1.2 THE DEFINITION OF HYPERMARKET

It is a gigantic discount retail complex that combines the features of supermarkets, department stores, and specialty stores under one roof. In commerce, a hypermarket (from the French hypermarché) is a store which combines a supermarket and a department store. The result is a gigantic retail facility which carries an enormous range of products under one roof, including full lines of fresh groceries and apparel. When they are planned, constructed, and executed correctly, a consumer can ideally satisfy all of their routine weekly shopping needs in one trip to the hypermarket.

In Malaysia there are some examples of hypermarket

- Jusco
- Carrefour
- Macro
- Tesco
- Giant

1.3 THE DEFINITION OF VIRTUAL REALITY

An artificial environment created with computer hardware and software and presented to the user in such a way that it appears and feels like a real environment. To "enter" a virtual reality, a user dons special gloves, earphones, and goggles, all of which receive their input from the computer system. In this way, at least three of the

five senses are controlled by the computer. In addition to feeding sensory input to the user, the devices also monitor the user's actions. The goggles, for example, track how the eyes move and respond accordingly by sending new video input.

1.4 PROBLEM STATEMENT

There got 5 important elements to take concentrate when doing this system. The first one is layout. We need to design and develop the system according to the goals, suitable navigation, size and perspectives of environments. The second is level of detail. Besides that we need to concentrate in interaction. We need to know the concept of user interaction with the environment. Next is navigation. This is about Navigation method and Degree of Freedom (DOF). The last one is feedback. Example: Sound, visual and the text prompts. All these things play important roles in the development.

If the VR application is developing in web-based, there are several problems that need to consider:

1. **Performance:** VRML files are typically large and processing is non-trivial, which result in substantial delays and high demands. Imagine a virtual 3D mall with many corridors and many stores where each store contains many 3D items.
2. Loading such a world over a 28.8kb modem could take a very long time.

Moreover even when loading is finished, a typical consumer machine may not

be strong enough to render the whole mall.

3. **Navigation:** Navigation in virtual 3D spaces is hard for the average user, using typical UI mechanisms. Controlling the mouse to maneuver to the desired direction requires a high level of coordination; in addition users just get lost in 3D spaces and can't find the right direction to move.
4. **Connectivity:** The web is based on a collection of pages linked together through hyperlinks, and much of its success comes from the ease of connecting (linking) pages created and stored independently. VRML does allow definition of links between spaces; however these links result in discarding the existing space and loading a new web page (which may contain another VRML space); these results in a discontinuity and loss of the virtual reality feeling. We show how to achieve a continuous and smooth transition between separately designed and stored spaces. We claim that having a continuous navigation between stores in a mall and even between departments of the same store is much more natural and intuitive than jumping in space.

1.5 PROJECT OBJECTIVE

This project is to develop a system that present hypermarket with 3D dimension environment. Besides that this system is providing information about the hypermarket to the customers. From this information, it can reduce the problems that occur when traveling or shopping at shopping mall. Moreover customer can study the

structure and architecture of hypermarket. So that customer can have a pre-concept of hypermarket before come to the real place. This system also provides back office for administrator login. It also provides stock checking ability. Final, this is a virtual directory of hypermarket for customer.

1.6 PROJECT SCOPE

First, information provided. Example you can know more about the hypermarket department, the category of goods, the item brands and price, stock amount and also the location of the stock in the hypermarket.

Interface with keyboard and mouse and guiding transportation provided in hypermarket. Standard desktop pc with standard monitor. Last, expose and introduce the environment of hypermarket to user.

1.7 IMPORTANT OF STUDY

From studying, there is such a way for problems solution. Knowledge is the key to success. Some more it can overlap with statement of problem situation. Here is some basic knowledge about the project and play a important role in the development.

With the use of Java [1], the developer has many classes available for building a GUI, for handling user events, and for producing two- and three-dimensional graphics.

Thus Java is often used to create tools for visualization. Virtual Reality Modeling Language (VRML) [2] is also a relatively new language that allows the developer to create three-dimensional “worlds”. With the use of VRML, a developer can describe 3D objects and combine them into scenes. VRML can be used to create interactive simulations that incorporate animation, motion physics, and real-time, multi-user participation.

The use of the X-VRML language for building active applications of virtual reality is proposed. X-VRML is a high-level XML-based language that overcomes the main limitations of the current virtual reality systems by providing convenient access to databases, object-orientation, parameterization, and imperative programming techniques. Applications of X-VRML include on-line data visualization, geographical information systems, scientific visualization, virtual games, and e-commerce applications such as virtual shops.

1.8 RATIONALE AND THEORETICAL FRAMEWORK

There are some 3D malls on the web today. Most of them use VRML but they either have a 3D entry page with links to 2D pages like The *gateway mall* [3] or they are 2D html pages with some 3D items like The *virtual reality mall* [4]. There are some Non VRML virtual malls such as *CompuServe's VRcade* [5] which is based on

Superscape's viscape [6]. This is a proprietary format and like traditional VRML solutions it does not scale to large malls. There are virtual stores, which are photographic based technologies like *Panoramix* [7], which allows a 360 panoramic view of stores. These technologies are not fully 3D and they are limited to the physical world that they represent, while we seek for a solution that is fully Virtual Reality and is not bound to physical world limitations.

1.9 TARGET USER

- First, this virtual reality application hypermarket is especially for hypermarket shoppers (end user) who want to know more about the hypermarket in different way. If this application uploads in the website, the end user can browse the hypermarket before they come to the real place. If install in the kiosk of the hypermarket, this application also can help customer about the location of the stock and let them know more the information and environment about the hypermarket.
- Second is for hypermarket management. The management can easily do the stock checking through the application.

1.10 RELEVANT TECHNOLOGY

The Virtual Reality Application Hypermarket will be developed using the following

technologies:

- Programming languages – use for develop the stock checking module
 - Java3d, C++ & Open GL
- Scripting – use for develop the virtual reality environment and modeling
 - Sense8 World Toolkit, VRML (Virtual Reality Modeling Language)
- Modeling tools – use for modeling object that in the application
 - 3D Studio Max, Maya

1.11 HYPOTHESES

Design a Virtual Reality Application for Hypermarket that same function as virtual directory of hypermarket which provides the information about the hypermarket department, the category of goods, the item brands and price, stock amount and also the location of the stock in the hypermarket. The user also can navigate the virtual environment. Meanwhile, the administrator can make stock maintenance at database.

1.12 EXPECTED OUTCOME

- This application is expected will develop the suitable domain and achieves the goals on behalf of the title. Moreover there should be a detailed virtual environment specification. This is the basic requirement of the application. Then the most important is that the application can fulfill the user needs and requirement. Last, the administrator can do stock maintenance as planning and expected.

1.13 REFERENCE

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<http://products.compuserve.co.uk/shoppingcenter/cserve.htm>
- [6] Superscape Interactive 3D Software,
<http://www.superscape.com/>
- [7] Panoramix, <http://www.software.ibm.com/net.media/solutions/panoramix/>

Others

ACM Digital Library – <http://portal.acm.org>

IEEE Xplore – <http://ieeexplore.ieee.org>

Google - <http://www.google.com>

Yahoo - <http://www.yahoo.com>

2.1 THE INTERNET HYPERMARKET

The Internet is a global network of computers that enables the exchange of information. It is a vast, interconnected system that allows users to communicate and share data across the world. The Internet has revolutionized the way we live, work, and play, providing a platform for everything from social media to e-commerce. The Internet is a global network of computers that enables the exchange of information. It is a vast, interconnected system that allows users to communicate and share data across the world. The Internet has revolutionized the way we live, work, and play, providing a platform for everything from social media to e-commerce.

CHAPTER 2: LITERATURE REVIEW

2.1 BACKGROUND STUDY

2.1.1 INTRODUCTION

To develop Virtual reality (VR) application for hypermarket, research and analysis are required to be done before development phase of the proposed system. A lot of information and issues that related with the Virtual reality (VR) application for hypermarket, such as definition of Virtual reality should be found for research and analysis. The information about database also required due to the Virtual reality (VR) application for hypermarket has its own database. The information of database focused on the MySQL which will be used in the Virtual reality (VR) application for hypermarket. Besides that scripting and language will also be discussed.

2.1.2 THE DEFINITION OF HYPERMARKET

It is a gigantic discount retail complex that combines the features of supermarkets, department stores, and specialty stores under one roof. In commerce, a hypermarket (from the French hypermarché) is a store which combines a supermarket and a department store. The result is a gigantic retail facility which carries an enormous range of products under one roof, including full lines of fresh groceries and apparel. When they are planned, constructed, and executed correctly, a consumer can ideally satisfy all of their routine weekly shopping needs in one trip to the hypermarket.

2.1.3 THE DEFINITION OF VIRTUAL REALITY

An artificial environment created with computer hardware and software and presented to the user in such a way that it appears and feels like a real environment.

To "enter" a virtual reality, a user dons special gloves, earphones, and goggles, all of which receive their input from the computer system. In this way, at least three of the five senses are controlled by the computer. In addition to feeding sensory input to the user, the devices also monitor the user's actions. The goggles, for example, track how the eyes move and respond accordingly by sending new video input.

2.1.4 DATABASE

There have a lot of database tools you can find in the worlds nowadays. The most familiar database tools such as: Microsoft SQL Server 2000, Microsoft Access, MySQL, Sybase Anywhere. These databases normally have their own algorithm. Some of the famous algorithms are:

- **Table**

Tables are database objects that contain all the data in a database. A table definition is a collection of columns. In tables, data is organized in a row-and-column format similar to a spreadsheet. Each row represents a unique record, and each column represents a field within the record. For example, a table containing employee data for a company can contain a row for each employee and columns representing employee information such as employee number, name, address, job title, and home phone number.

● Database Designer

The Database Designer is a visual tool allowing you to design and visualize a database to which you are connected. When designing a database, you can use the Database Designer to create, edit, or delete tables, columns, keys, indexes, relationships, and constraints. To visualize a database, you can create one or more diagrams illustrating some or all of the tables, columns, keys, and relationships in it.

● Query

- Create queries and other SQL scripts and execute them against SQL Server databases. (Query window)
- Quickly create commonly used database objects from predefined scripts. (Templates)
- Quickly copy existing database objects. (Object Browser scripting feature)
- Execute stored procedures without knowing the parameters. (Object Browser procedure execution feature)
- Debug query performance problems. (**Show Execution Plan, Show Server Trace, Show Client Statistics, Index Tuning Wizard**)
- Locate objects within databases (object search feature), or view and work with objects. (Object Browser)
- Quickly insert, update, or delete rows in a table. (Open Table window)

2.1.5 SCRIPTING AND LANGUAGE IN VIRTUAL REALITY

➤ Development History:

VRML 1.0 standard were selections of a core set of object-oriented graphics constructs augmented by hypermedia links, all suitable for scene geometry rendering

by Web browsers on personal computers or workstations. There were two major limitations in VRML 1.0: a lack of support for dynamic scene animation and having no traditional programming language constructs. Difficult issues regarding real-time animation in VRML 1.0 included entity behaviors, user-entity interaction, and entity coordination.

VRML 2.0 development tackled these issues directly, using event-driven ROUTEs to connect 3D nodes and fields to behavior driven sensors and timing. “Language wars” were avoided by allowing other programming languages to communicate with the VRML scene via a Script node. Using Java is the most powerful way for 3D scene authors to explore the many possibilities provided by VRML.

➤ **3D Graphics Nodes:**

Most programmers find that there are many unfamiliar language concepts and terms in VRML an overview of this admittedly large language is necessary before describing how Java works in combination with it. This section describes the 3D-specific VRML nodes specify in shape, geometry and appearance.

➤ **Scene Topology: Grouping and Child Nodes**

VRML syntax and node typing also help enforce a strict hierarchical structure of parent-child relationships so that browsers can perform efficient rendering and computational optimizations. This section summarizes the full scope of VRML, the language; readers familiar with 3D graphics concepts may prefer skipping ahead to

the Java section in grouping, grouping and the web, lighting and the sound, viewing, action sensory, animation interpolator, prototypes and graphics example.

- VRML and Java: Scripts, Events, Naming and ROUTES:

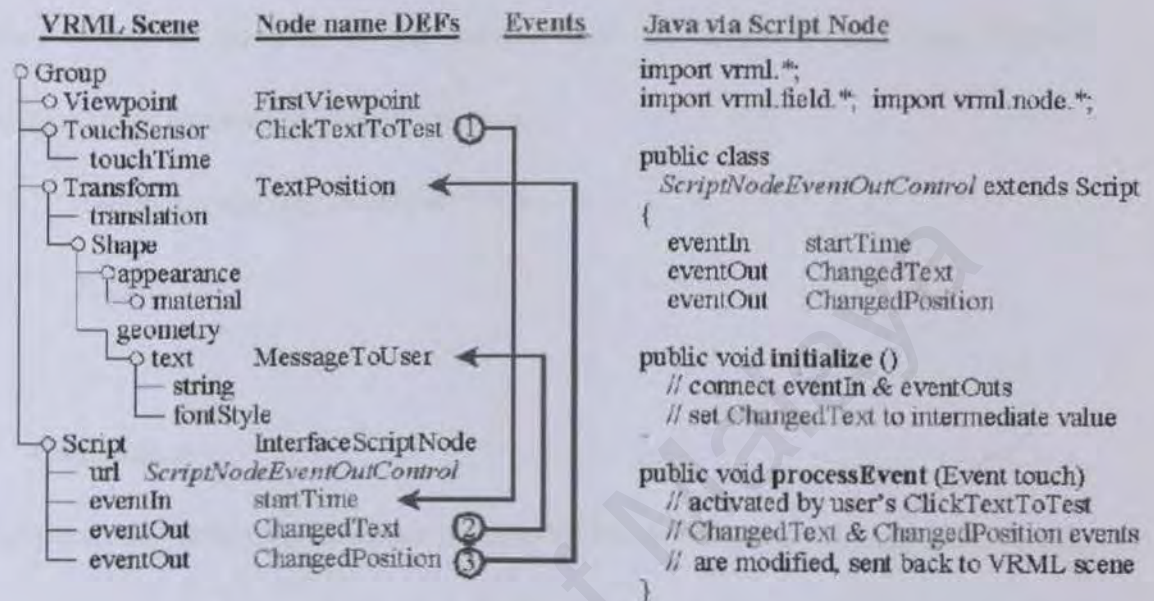


Figure 3. Script node interface between VRML and Java. This example tests event-based VRML-Java functionality. Note start Time, ChangedText, and ChangedPosition.

Figure 2.1- Script node interface between VRML and Java

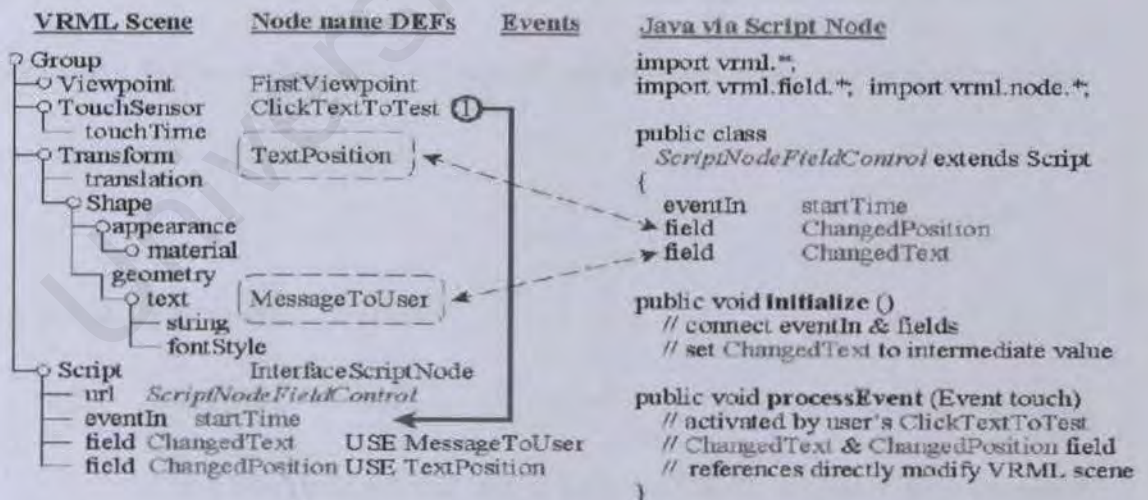


Figure 4. Field interface between VRML and Java. This example tests field-based VRML-Java functionality. Note shared start time, and shared fields ChangedText and ChangedPosition. Operation of this example is similar to Figure 3, except that class directly manipulates VRML nodes via fields instead of sending events.

Figure 2.2 – Field interface between VRML and Java

➤ **Future Language Interfaces:**

Java via VRML's Script node is well specified and multiple compliant browsers exist. Other interfaces are also on the horizon that can further extend Java- VRML functionality as described in the following:-

- i. External Authoring Interface (EAI)
- ii. Java3D

➤ **Conclusion:**

The paper do further the research in Java-VRML by some given example. VRML scenes in combination with Java can serve as the building blocks of cyberspace. Large-scale internetworked worlds now appear possible. Using VRML and Java, practical experience and continued success will move the field of virtual reality past speculative fiction and isolated islands of research and onto desktops everywhere, creating the next-generation Web.

2.2 TOOLS LISTING

2.2.1 3D Max

3D Studio MAX [2] has a built-in VRML exporter that translates MAX files into VRML files. Here are the basic steps for creating a VRML file in 3D Studio MAX:

- ✓ Create geometry

- ✓ Create lights and cameras
- ✓ Assign materials and texture maps
- ✓ Animate
- ✓ Insert VRML helper objects
- ✓ Export to VRML
- ✓ Use a VRML browser to test the file
- ✓ Optionally, use a text editor to edit the file.

3D Studio Max [6] (sometimes called 3ds Max or just MAX) is a 3D computer graphics and animation program, written by Autodesk Media & Entertainment.

Modeling [4] is the basic of virtual navigation system. Here, using the VRML as the modeling language because the VRML [7] (Virtual Reality Modeling Language) is a standard file format for representing 3-dimensional (3D) interactive vector graphics, designed particularly with the World Wide Web in mind. To a desktop virtual reality system, the design of virtual environment is limited by the hardware condition and also the bandwidth of the user access. The model with too much detail will slow down the navigation speed. However, too simple model will not bring good view effects.

2.2.2 Web-based server

The system [3] of web-based should include user interface layer, business logic layer (function layer) and data-access layer. This is divided into two parts: the server end and the client end. If there is protective firewall between them is better. The client end and the server end can be linked together by Internet at any place and any time. The host server includes the file server, the database server, WWW server, the producer for dynamic web page and 3D object. There is also a functional Computer Gateway Interface (CGI) [5] for general processing. The file server contains pre-made HTML templates, which are for the dynamic pages, along with 3D object files (e.g., VRML files) are for the 3D models.

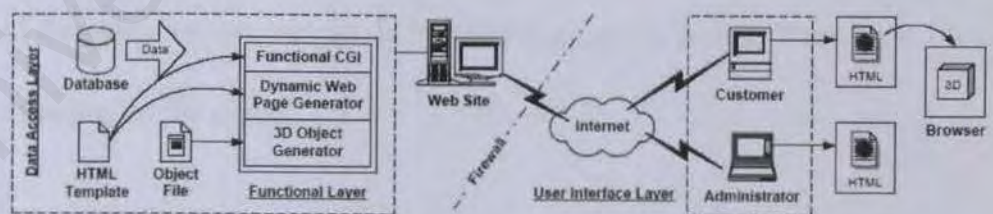


Figure 2.3: Web-based client/server architecture for mass customization of product

2.2.3 Virtual Guider

Role cartoon technology [3] use to design the virtual guider: first, the

role model is set up as the motive system; then the system will move like alive. The role cartoon is designed with Character Studio 3.X role cartoon system that provides methods of setting up and modifying roles including tools to create group cartoon. Character Studio [8] is a plug-in which makes the animation of characters and crowds easier in 3ds max. Character Studio provides various unique tool groups for motion-catching, the free cartoon style as well as the step-trace cartoon. Here, using virtual bones to control the points on the limbs and these bones make up the skeleton of the role. The role to put up various poses and adjusting the skeleton. It should be noted that the points on some places often have problems of dragging the skin and the muscle, that is, here may be dragged by other parts of the body or stay at the same place uncontrolled by the skeleton. This is caused by the unreasonable distribution of the weight of the skeleton. To get rid of the phenomenon, we can do by adjusting and controlling the weight of points on the model.

2.2.4 Path-Planning

To combine the path of the virtual guide and the inquiry of the product in the mall, here introduce the 3D Studio MAX model into VRML, and then implement the algorithm optimizing the whole path by programming in JAVA and XML. This algorithm presents the virtual

environment using the girding method. The data structure of the octo-tree is used to represent the discrete environment. Every node of the tree represents a cell and includes a table of eight pointers pointing to the other nodes. The null pointer represents a free cell. The 3D environment can be divided into the borderline, the free zone and the blocking zone according to their accessibility. The heuristic overall search algorithm of width priority is applied.

Optimization algorithm of overall path:

1. Mark all borderline cells
2. Use three kinds of heuristic knowledge:
 - ✓ How to select the cells neighboring the current cell
 - ✓ How to define the order of the neighbor cell under measurement
 - ✓ Some additional conditions about those neighbor cell under measurement
3. Get the heuristic function: $r(n) = g(n) + h(n)$, $g(n)$, $h(n) > 0$, $g(n)$ represents the cost moving from the beginning to node n , $h(n)$ represents the estimated cost moving from node n to the target node, $r(n)$ represents the total cost
4. Search as follows:
 - ✓ Search a path from the start to the end using the width priority rule according to the heuristic function and the relevant heuristic

knowledge.

- ✓ Form a new octo-tree with the node along the above path and the heuristic knowledge

- ✓ Get an path-optimized tree by searching the new octo-tree using the Dijkstra algorithm

5. Complete the whole process

2.2.5 VRML

VRML (Virtual Reality Modeling Language), [9] designed for 3D rendering on the web. VRML is a text file format (like HTML) for describing interactive 3D objects and worlds on the Web. VRML 1.0 was finalized on Nov 95 and described static 3D worlds. VRML 2.0 was published on Aug 96 and added dynamic and scripting capabilities to VRML worlds. The VRML browsers are embedded as Plug-in in the popular Web browsers Netscape's Navigator and Microsoft's Internet Explorer. Having a standard for 3D is very important, but there is a big barrier for real applications and in particular for e-commerce based on VRML.

Analyzing the reasons for the slow and limited adoption of VRML yields the following:

- ✓ Performance: VRML files are typically large and processing is

non-trivial, which result in substantial delays and high demands. Imagine a virtual 3D mall with many corridors and many stores where each store contains many 3D items. Loading such a world over a 28.8kb modem could take a very long time. Moreover even when loading is finished, a typical consumer machine may not be strong enough to render the whole mall.

✓Navigation: Navigation in virtual 3D spaces is hard for the average user, using typical UI mechanisms. Controlling the mouse to maneuver to the desired direction requires a high level of coordination; in addition users just get lost in 3D spaces and can't find the right direction to move.

✓Connectivity: The web is based on a collection of pages linked together through hyperlinks, and much of its success comes from the ease of connecting (linking) pages created and stored independently. VRML does allow definition of links between spaces; however these links result in discarding the existing space and loading a new web page (which may contain another VRML space); this result in a discontinuity and loss of the virtual reality feeling. To achieve continues and smooth transition between separately designed and stored spaces. Having continues navigation between stores in a mall and even between departments of the same store is much more natural and

intuitive then jumping in space.

The Virtual Reality Modeling Language (VRML) [9] defines the nodes Anchor, Inline and LOD (Level of Details). Anchor is a hypertext link to another space, which does not support the continuity feature. Inline allows embedding a 3D space in another space; however the spec does not define when Inlines are loaded and some browsers load all the Inlines in advance which can not tolerate very large spaces. In fact, it may be impossible for the browser to properly predict when to load inline objects. Level of details (LOD) is a mechanism to load spaces according to distance of the viewer from them. Like Inline the specification does not specify when LOD nodes are loaded but just when they are displayed, so again some browsers load LODs in advance.

2.2 SYSTEM COMPARING

The system [3] in comparing with the research is a prototype in the literature review with the title “A 3D Virtual Shopping Mall That Has the Intelligent Virtual Purchasing

Guider and Cooperative Purchasing Functionalities” by Yiming Zhao, Lijun Guo, Xiaoli Wang, Zhigeng Pan from Department of Computer Science & Technology (NingBo Uinversity, Ningbo) and State Key Laboratory of CAD&CG (Zhejiang University Hangzhou) of china.

This system is a multi-user interactive virtual purchasing environment. In this environment, there is a symbol with mood for every customer, which can communicate freely with symbol of other customers, commodities in the shopping mall and the intelligent agent. In the meantime, a virtual purchasing guider is designed to communicate with different symbols of customers in different manners. This virtual guider is able to patrol in this virtual environment along the path planned by it own. Customers may have dynamic communication with other purchasers through the virtual guider or operate interactively on all kinds of commodities. This system simulates the whole purchasing process including window-shopping, choosing and paying for the items. Such comprehensive simulation is a new makes the customer feels like they are personally on the scene.

The theory and technique of this system had been justified on the above section. The theory using are 3dsmax, virtual guider, path-planning and web server. For more detail information, please refer to above section. Among the system had been read, this system is the most interactive and reactive system. The function like virtual guider and path-planning allowed the user interactive with the system in real-time. The system also will give the feedback at that time. This is a communication between the system and the user, so the programming part of the system in interactive with the user had write in an advancing language like JAVA. In JAVA language, the algorithm was using to presents the virtual environment by the girding method. The data structure of the octo-tree is used to represent the discrete environment. The theory using in this system was suitable to let us using in the research. In order to create an

interactive environment which is user friendly, the virtual guider and path-planning technique is needed.

2.3 CONCLUSION

Literature review is a crucial part in a system development cycle. A lot of information, ideas and knowledge should be gathered to develop research system through the process of doing the literature review.

In comparing the system, the theory which suitable to this research had been defines. In the following steps, the research will be more detail in handling the theory recommend and try to master the technique to apply in the research topic. By doing this, another advancing Virtual Reality Hypermarket will be invented.

2.4 REFERENCE

VRCommerce — Electronic Commerce in Virtual Reality

A 3D Virtual Shopping Mall That Has the Intelligent Virtual Purchasing Guider and Cooperative Purchasing Functionalities

The Design of Desktop Virtual Reality Environment Based on VRML---- Digital TJU Navigation System

Web-based Virtual Reality Catalog in Electronic Commerce

http://en.wikipedia.org/wiki/3D_Studio_Max

<http://en.wikipedia.org/wiki/VRML>

http://en.wikipedia.org/wiki/Character_studio

<http://library.ucsc.edu/ref/howto/literaturereview.html>

<http://www.webdevelopersjournal.com/articles/vrml/start1.html>

2. INTRODUCTION

A *web developer's journal* is a web site that contains a collection of articles, tutorials, and other information that is useful to web developers. The journal is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge. The journal is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge. The journal is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge.

Web developers are the people who create and maintain web sites. They are responsible for the design, development, and maintenance of web sites. They use a variety of tools and technologies to create web sites, including web browsers, web servers, and web development languages. They also use a variety of techniques to design and develop web sites, including user interface design, database design, and network design.

The *web developer's journal* is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge. The journal is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge. The journal is a place where web developers can find out about the latest trends in web development, and where they can share their own experiences and knowledge.

Table 3.1: Software Life Cycle Criteria Checklist

Criteria	Waterfall	Prototype	V-Type	Incremental	Spiral
Availability of resources	All	Some	All	Some	Some
Complexity of project	Low	Medium	Low	High	High
Problem domain knowledge	High	Fair	High	Poor	Poor
Product technology	Existing	New	Existing	New	New
Requirements volatility	Low	High	Low	Medium	High
Risk management perspective	No	Yes	No	No	Yes
Schedule constraint	Medium	Low	Medium	Medium	Medium
Understanding of user requirements	Specific	Vague	Specific	Vague	Vague

3.1.1 SYSTEM DEVELOPMENT MODEL

3.1.1.1 Waterfall Model

The Waterfall Model is the earliest method of structured system development. It is a linear life cycle with feedback loops. It is still widely used even though it has come under attack in recent years for being too rigid and unrealistic when it comes to quickly meeting customer's needs. It is attributed to provide the theoretical basis for other process models.

Strengths:

- Documentation driven as documentation is provided at each phase.
- Easy to understand, simple and familiar to most developers.

- Easy to maintain and associate measures, milestones and deliverables with the different stages.

Weaknesses:

- Does not reflect how software is developed because it cannot show the order of events.
- Not applicable for many types of development.
- Does not reflect which stage to backtrack.

3.1.1.2 Prototyping Model

The Prototyping Model is an idea of developing an initial implementation, exposing this to user comment and refining this through many versions until an adequate system has been developed. It is a working model of the system built to learn about its true requirements. By using this model, the developer builds a simplified version of the proposed system and presents it to the customer for consideration as part of the development process. The customer in turn provides feedback to the developer. The prototype code is usually thrown away and entirely new programs are developed once the requirements are identified.

Strengths:

- Provides the user with a tangible means of comprehending and evaluating the proposed system and elicits and more meaningful feedback.
- Misunderstanding of the requirements and missing functions can be identified in the early stage.

- The errors and problems which encounters during the development of system can be corrected and solved.
- Can be built quickly and helps to ensure system performs adequately.

Weaknesses:

- Prototyping can use up a lot of resources, especially when it fails completely and must be scrapped.
- The extra time spent in prototyping is not warranted.

3.1.1.3 V Model

Initially defined by the late Paul Rook in the late 1980s, the V was included in the United Kingdom's National Computing Centre publications in the 1990s with the aim of improving the efficiency and effectiveness of software development. It is accepted in Europe and the U.K. as a superior alternative to the Waterfall Model. In fact, the V Model emerged in reaction to some Waterfall Models that showed testing as a single phase following the traditional development phases of requirements analysis, high-level design and detailed design and coding. It demonstrates how the testing activities are related to analysis and design.

Strengths:

- Allow the process to have testing and coding as a parallel activity which enables the changes to occur more dynamic.
- Better spells out the role of different types of testing.
- The users are involved in testing.

- Each step is base lined before proceeding to the next as development goes hand in hand with testing and validation.

Weaknesses:

- Extensive testing may not always be cost-effective and some drawbacks are same as Waterfall Model.

3.1.1.4 Incremental Model

The development and delivery is broken down into increments where each increment delivering part of the required functionality. User requirements are prioritized and the highest priority requirements are included in early increments. Each stage consists of design, code and unit test, integration test and delivery.

Besides that, it provides tangible measures of progress. However, a careful planning is required at both the project management level and the technical level.

Strengths:

- Allow fast deliver on important parts as additional functionality can be added to each stage.
- Expertise can be applied to different releases and problems can be fixed quickly.
- Reduces time to when customer receives some product. Therefore, customer can be trained earlier.

Weaknesses:

- Changes may have to be made to completed parts so that the new parts can be started.
- Problem may not be easily decomposable.

3.1.1.5 Spiral Model

The Spiral Model is a risk-driven process model generator. It is used to guide multi-stakeholder concurrent engineering of software-intensive systems. It has two main distinguishing features. One is a cyclic approach for incrementally growing a system's degree of definition and implementation. The other is a set of anchor point milestones to ensure stakeholder commitment to feasible and mutually satisfactory system solutions.

The full Spiral Model is preceded each phase by alternatives and risk analysis, followed each phase by evaluation and planning of the next phase.

Strengths:

- No distinction is made between development and maintenance.
- It is easy to judge how much to test.
- Prototyping can be done at any stage.
- Encourage risk reduction.

Weaknesses:

- The project is immediately terminated if all risks cannot be mitigated.
- New and untested.

- For large scale software and internal (in-house) software only.

3.1.2 CHOSEN SYSTEM DEVELOPMENT MODEL

During the development of E-thesis system, V model is selected as the basis of process life cycle model because it describes mature and internationally recognized activities for software development.

3.1.2.1 Why V Model?

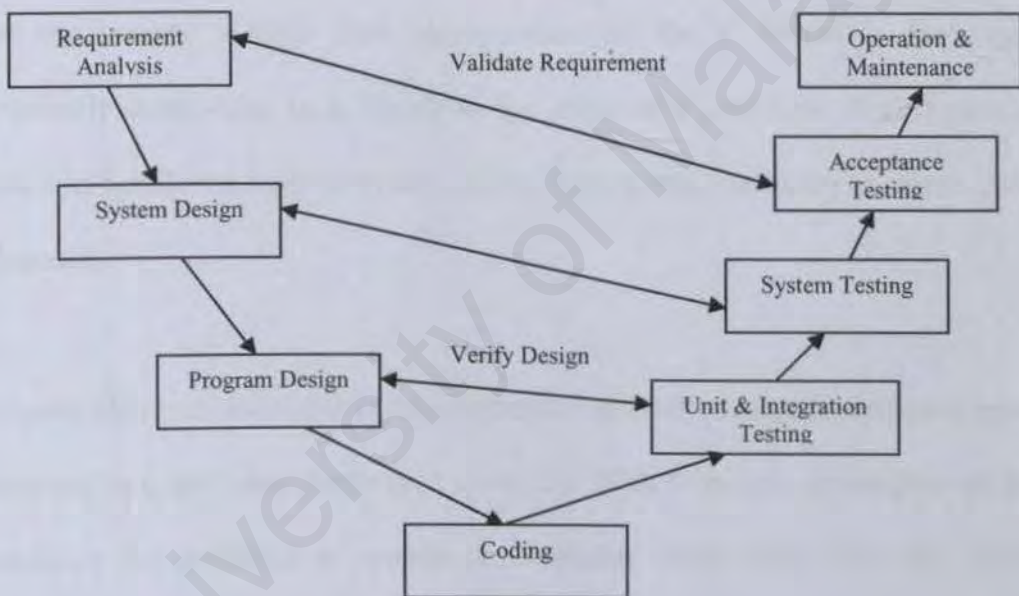


Figure 3.1 -V Model

The V model is a method of software development, which allows visibility of where we are by stages. Development goes hand in hand with testing and validation, where each step is base lined before proceeding to the next. In addition to the planned products and activities, the V-Model also contains information about the course the project will take. To this end, the process standard includes which output products

are to be created by an activity and which successor activities need this product as input. The V shows the typical sequence of development activities on the left-hand (downhill) side and the corresponding sequence of test execution activities on the right-hand (uphill) side.

Besides that, V Model in the SDLC will allow the process to have testing and coding as a parallel activity which enables the changes to occur more dynamic. While admittedly obscure, it gives equal weight to testing rather than treating it as an afterthought. It also delivers structured documents at each defined milestones, which makes the process visible. This characteristic of the V Model is the key to automatically controlling an E-thesis in the sense of a workflow. It also provides guidance to handle changes to system and activities that are likely to occur during development.

This model also contains validate requirements and verify design functions to ensure all elements in every stage performed correctly. With V model, developers are able to minimize the mistakes in system development while make sure the client's requirement have been fully implemented.

3.1.2.2 Activities in V Model

V Model consists of eight stages that are depicted as cascading from one to another. Each development stage should be completed before the next phase begins. However, there are some phases that can be iterated too. The fundamental development activities are:

- **Requirement Analysis**

Software requirement analysis defines functional capabilities, performances, design constraints and system interfaces. During this process, it involves analyzing the problem encountered and identifying the users' requirements. It provides the software designer with representation of information and function that can be translated to data, architectural and procedural design. The software scope, initially established by the system engineer and refined during software project planning is refined in detail. Alternative solutions are analyzed and allocated to various software elements. To capture requirements, several steps have been taken such as survey and questionnaire session.

- **System Design**

System design involves representing the software system appearances and functions from the user's perspective by having feasibility studies and case studies on current theses management system. It establishes an overall system architecture, process partitions the requirements to either hardware or software system and verifies system design.

- **Program Design**

After the previous phases were approved, the all system design is used to generate the design of the individual program involved. The algorithms for each module will be defined in the design tree that will be realized as code.

- **Coding**

Coding is complete and verified set of program components. This process involves transforming algorithms into a computer understandable language. Programmer will write the programs based on the approved program design.

- **Unit And Integration Testing**

Testing is the process of checking each coded module for the presence of bugs and making sure that each unit satisfied its specification. When the program has been written, they are tested as individual pieces of code, which called unit testing. The code artifacts are then compiled and integrated to form subsystems, which called integration testing. The purpose of unit and integration testing is to make sure that the system can fulfill all the requirements and specifications of the assigned system based on the program design phase. This stage will also interconnect sets of previously tested modules to verify their design as independently tested modules.

- **System Testing**

System testing involves a test of the whole system to make sure that the functions and interactions specified initially have been implemented properly according to system requirements. It also verifies the system design, making sure that all system design aspects are correctly implemented. Thus, validation makes sure that the developer is building the right product whereas verification checks the quality of the implementation.

- **Acceptance Testing**

This phase is conducted by the customer to validate the requirements by associating a testing with each element of the specification.

- **Operation And Maintenance**

Operation and maintenance is the longest life cycle phase. After system is accepted, E-Thesis will be installed and put into practical use. Maintenance process is carried out throughout the life of the system to correct errors and make adoption of the software for external and internal changes. Besides that, the system will be enhancing from time to time if new requirements are discovered.

- **Verify Design**

Every units, integration parts and system is verified to reduce error during system development and to ensure the contents meet its specifications.

- **Validate Requirements**

Before the system is accepted, it will be revalidating to ensure every client's requirements have been correctly implemented.

3.2 INFORMATION GATHERING METHOD

Information gathering method refers to the methods that are used to gather information regarding a system. It is necessary to employ the fact-finding techniques in order to establish understanding of the state and future requirements. Information helps to build an informative web-based E-Thesis and deliver a best function to the user. There are several types of systematic fact finding techniques used in the development cycle of E-thesis system.

3.2.1 PRINTED MATERIAL

The secondary method of collecting data and information about the system is by printed materials such as reference books, journals, research papers and past year's theses. Reading on printed material is a traditional but effective approach to get a better picture on how to develop and design the system. It plays an important role towards the success of E-Thesis as it offers magnificent ideas as well as useful information. Besides text, graphics and tables from printed materials contribute nevertheless the most information too.

I went to library to search those printed material related to thesis in order to have more understanding on E-Thesis. Besides that, I also went to FSKTM's document room to review some senior's theses to get some guidance in preparing this thesis. However, I found that most of the information on printed material is not up-to-date.

3.2.2 INTERNET RESEARCH

Internet is the main resource to search for information and to refer any ambiguities that arise during the entire development period. As the exchange portal of information, Internet Research offers more valuable information than anywhere else by providing a wide range of electronic media or sources such as online articles, online journals, online directories and etc. The new breed fact-finding technique provides helpful alternative to search information and gain knowledge required in the development cycle.

Through the Internet, I studied the existing related web-based thesis management system. Idea can be generated by observing the existing systems. This helps me to focus on the functionalities of the system thus ease the development process. Besides that, I also found out some interesting web design from Internet.

Major search engines such as Googles, Excite, Yahoo, Search and Metacrawler enable relevant information sites to be viewed with only a click away.

3.2.3 APPLICATION SURVEY

100 sets of questionnaire had been done to get some opinions about the development of the E-Thesis system. The people to be questioned are widely dispersed that range from various walks of life. Through the survey, I can get the overall opinion from different types of people before the system project is given any specific direction while maintaining uniform responses.

3.2.4 DISCUSSION WITH SUPERVISOR

Discussions have been made with my supervisor from time to time for smoothing out the progress of my project. Further details and idea on how to develop an E-Thesis system are gained from discussion. It is also used to determine what the supervisor considers the success of E-Thesis based upon. Furthermore, supervisor also gives extremely advice, guidance and supports to me in order to explore more advance knowledge and to improve my project performance.

3.2.5 CONVERSATION

Informal conversation was held with friends as they would be able to provide their opinions from the point of view of a system user to get extra information. Each person will probably have a different view of E-Thesis because each person will interact with the system differently when it is built. Therefore, the data collected and reported by the system addresses the needs of varying audiences.

3.3 TECHNOLOGY REVIEW

3.3.1 SYSTEM ARCHITECTURE

The first significant wave was comprised of centralized operations based on mainframes. The first shift from this option followed the introduction of the minicomputer with the same architecture. The second wave of computing occurred with the introduction of the personal computer in the early 1980s and the following introduction of the client/server architecture. The most recent transformation is toward a heterogeneous Internet platform. The host-based platforms and client/server architecture remain important although new businesses focus on the ubiquitous Web platform.

Some types of architecture that present in network environment and reveal the strengths and weaknesses of each type of the architecture are shown below.

3.3.1.1 Host-Based Architecture / Mainframe Architecture

All intelligence is within the central host computer with mainframe software architectures. Users interact with the host through a terminal that captures keystrokes and sends that information to the host.

Strengths:

- Easy client installation and reliable.
- Not tied to a hardware platform.

Weaknesses:

- Cannot easily support graphical user interfaces (GUI) or access to multiple databases.
- Requires a complex operating system.
- Produces substantial network traffic.
- Expensive to maintain and older technology.

3.3.1.2 Client/Server Architecture

Mainframes have found a new use as a server in client/server architectures in the last few years. Client/server architecture is a combination of a client or front-end portion that interacts with the user and a server or back-end portion that interacts with the shared resource. This approach introduced a database server to replace the file server for easier development and better maintainability. User queries could be answered directly by using a relational database management system (DBMS). The server's

task was simply to process as many requests for data storage and retrieval as possible. The client/server architecture improves multi-user updating through a GUI front end to a shared database.

An important characteristic of client-server systems is scalability. They can be scaled horizontally or vertically. Horizontal scaling means adding or removing client workstations with only a slight performance impact whereas vertical scaling means migrating to a larger and faster server machine or multi servers.

- **Two-tier Architectures**

In two tier client/server architectures, the user system interface is usually located in the user's desktop environment while the database management services are usually in a server which is a more powerful machine that provides services to many clients. Processing management is split between the user system interface environment and the database management server environment.

Strengths:

- Inexpensive workstation software and ideal for large business corporation.
- Allow multiple users to simultaneously access the same application data, updates from one computer were instantly made available to all computers that had access to the server.

Weaknesses:

- Limited flexibility in moving program functionality from one server to another without manually regenerating procedural code.
- Server is expensive.

- Changes to the business logic at the server require changes to presentation layer.
- The binding of the graphical interface to the data source consumes major resources on the client machine, which results in poor performance.
- The inability of a two-tier approach to grow beyond the physical boundaries of a client machine and a server machine prevents this model from being scalable.

• **Three-tier Architectures**

A middle tier is added between the user system interface client environment and the database management server environment in three-tier architecture. The middle tier can perform queuing and application execution. Recently, mainframes have found a new use as servers in three tier architectures.

Strengths:

- Improve flexibility in deployment and design and performance for groups with a large number of users if compare to two tier applications.
- The time of investing in designing and implementing components is not wasted because applications can be shared.
- The centralization of components for reuse has an added benefit. They become easier to redeploy and maintain when modifications are made, thus keeping pace with business needs.
- Encapsulation of application's services into components enables large, complex applications to be broken down into more manageable pieces.

Weaknesses:

- Complicated infrastructure, high costs, multiple vendors.
- The development environment is more difficult to use.

3.3.2 APPLICATION PLATFORM

Different kinds of application will run in different platform. An operating system is the software that controls the overall activity of a computer and ensures that all parts of a computer system work together smoothly and efficiently.

3.3.2.1 UNIX

Traditionally used on minicomputers and workstations in the academic community, UNIX is now available on personal computers and the business community has started to choose UNIX for its openness. UNIX has evolved as a kind of large freeware product with many extensions and new ideas provided in a variety of versions of UNIX by different companies, universities and individuals.

UNIX, like other operating systems, is a layer between the hardware and the applications that run on the computer. UNIX has many built-in security features to protect information from being accidentally deleted or accessed by unauthorized users. It has functions that manage the hardware and the executing of applications. UNIX includes the traditional operating system components.

One of the greatest strength of UNIX is the consistent way in which it treats files. Users do not need to learn special commands for every new task when working with files. Besides, UNIX is able to combine functions and commands. It is available as

free software and open system for total user control. However, it is hard to install and set up than most other operating systems. It is case sensitive and non-sensible syntax.

3.3.2.2 LINUX

Linux is a UNIX-based operating system that available on the Internet. It is almost free to relatively inexpensive. It can be downloaded off the Internet which makes it free or close to it. Many companies such as Red Hat, Corel and Mandrake, create easy-to-use versions of Linux that can be purchased.

Linux is more stable than other modern operating systems. It is truly multi-user and multi-tasking and comes with commercial-grade applications that make office work simple. Furthermore, bugs can be fixed quickly. However, Linux is hard to install, learn and use. As a result, there is no one commercial company is responsible for Linux and it is not as popular as Windows.

3.3.2.3 WINDOWS NT

Microsoft Windows NT is one of the powerful operating systems for business computing that provides advanced networking and security features. It combines the ease-of-use of Windows 95 with the power and reliability of Windows NT. It is also a powerful operating system that reliable, secured, multithreaded, symmetric processing and support client/server system and some peer-to-peer networks.

Windows NT is a complete platform available for building and hosting web based application. It is used to publish and share information securely over corporate Intranet and Internet. It can control the access control of user in accessing certain file

or application. Besides, it supports a wide range of networks protocol and Remote Access Protocol. This makes it easy for us to develop the distributed application. Windows NT also enables the capabilities of integrating applications on a single computer or even across multiple computers. Apart from that, thousands of bugs have not been found and fixed. Windows NT requires a special hardware drivers and many devices will never be supported.

3.3.2.4 WINDOWS 2000

Windows 2000 (W2K) is a commercial version of Microsoft's evolving Windows operating system. It is designed to appeal to small business and professional users as well as to the more technical and larger business market for which the NT was designed. The Windows 2000 product line consists of four products: Windows 2000 Professional, Windows 2000 Server, Windows 2000 Advanced Server and Windows 2000 Datacenter Server.

Windows 2000 is stable, reliable, strong security and corporate-management capabilities. It enables a company to set up virtual private networks, to encrypt data locally or on the network and to give users access to shared files in a consistent way from any network computer. It also enhanced features for notebooks including hot swapping of PC Cards. Nevertheless, it is expensive and fairly hefty hardware requirements.

3.3.3 MARKUP LANGUAGE

3.3.3.1 HTML

HyperText Markup Language (HTML) is the coding language used to create Hypertext documents for use on the World Wide Web. Without HTML, the World Wide Web would not exist. It allows the individual elements on the Web to be brought together and presented as a collection. In addition to being a markup language for displaying text, images, and multimedia, HTML provides instructions to Web browsers in order to control how documents are viewed and how they relate to each other. HTML also can show database record in the Internet and get response from other users.

However, HTML is a static web page where the content will never change. Web authors today face significant challenges when making their Web pages interactive. The static nature of HTML pages limits their creative choices and interactive components can be difficult to build. Normally, HTML files are "interpreted" in a user's web browser (on the client side).

3.3.3.2 DHTML

Dynamic HTML is developed by Netscape and the World Wide Web Consortium (W3C), is based entirely on industry-standard HTML and Java. It is a collective term for a combination of new HTML tags and options, style sheets and programming that create Web pages more animated and more responsive to user interaction. It specifies exactly how text and images will be displayed on a web page and allows web pages to react to the end users' input.

Dynamic HTML gives authors creative control so that they can manipulate any page element and change styles, positioning and content at any time. New features in Dynamic HTML, such as absolute positioning, give designers and developers greater control over the look and feel of web pages. It also allows Web documents to look and act like desktop applications or multimedia productions. Users may add their own VBScript and JavaScript inside HTML to make it become a dynamic HTML.

3.3.3.3 XML

Extensible Markup Language (XML) is a markup language for documents containing structured information. Structured information contains both content such as words and pictures and some indication of what role that content plays. It describes a class of data objects called XML documents which are stored on computers and partially describes the behavior of programs that process these objects. It uses Document Type Definition (DTD) or an XML Schema to describe the data.

XML was developed by the SGML Editorial Board formed under the auspices of the World Wide Web Consortium (W3C) beginning in 1996. XML became a W3C Recommendation on February 10th, 1998. This means that XML has been reviewed and approved by the members of the W3C. XML is therefore deemed "stable" and ready for widespread deployment. A Recommendation is the highest level a W3C document can be assigned.

XML allows the author to define his own tags and his own document structures. It is free, extensible and going to be everywhere. It will be as important to the future of the Web as HTML has been to the foundation of the Web. It is believed to be the most common tool for all data manipulation and data transmission.

3.3.3.4 VRML

VRML (Virtual Reality Modeling Language) is a standard file format for representing 3-dimensional (3D) interactive vector graphics, designed particularly with the World Wide Web in mind. VRML is a text file format where, e.g., vertices and edges for a 3D polygon can be specified along with the surface color, image-mapped textures, shininess, transparency, and so on. Animations, sounds, lighting, and other aspects of the virtual world can interact with the user or may be triggered by external events such as timers. A special Script Node allows adding program code (e.g., written in Java or JavaScript (ECMAScript)) to a VRML file.

3.3.4 PROGRAMMING LANGUAGE

3.3.4.1 JavaScript

A simple and first scripting language developed by Netscape to enable greater interactivity in Web pages. It shares some characteristics with Java but is independent. It was designed to resemble Java, which in turn looks a lot like C and C++. The difference is that Java was built as a general-purpose object language, while JavaScript is intended to provide a quicker and simpler language for enhancing Web pages and servers.

JavaScript is embedded as a small program in a web page that is interpreted and executed by the Web client. Besides that, it can be used to fully control Netscape and Microsoft Web browsers, including all the familiar browser attributes. It is designed for use by web designer to dynamically script the behavior of objects running on

either the client or the server. It also interacts with HTML, enabling dynamic content and motion thus makes Web pages interactive in a variety of ways.

3.3.4.2 PHP

PHP, depending on who you talk to, either stands for Personal Home Page or for PHP Hypertext Preprocessor is a general purpose language. It is normally put to use as an html-embedded scripting language for use on the web. With the current direction of the Web, it is easily being adapted to writing out all forms of XML content as well. It was originally developed as a set of server-side modules to perform some specific Web-server tasks on small, Unix-based Web servers.

PHP is a widely used Open Source server-side general-purpose scripting language that is especially suited for Web development. It is free and easy to implement, to learn and to use. It runs on almost any platforms and can be used as a standalone executable or as a module under a variety of web servers. It has excellent support for databases, XML, LDAP, IMAP, Java, various Internet protocols and general data manipulation. It is also extensible via its powerful API.

3.3.5 WEB APPLICATION DEVELOPMENT TOOLS

3.3.5.1 Microsoft Front Page

Microsoft FrontPage is a Web authoring tool designed for non-programmers to build the pages for a Web site. It is a member of the Microsoft Office family, and looks and works like other Office applications. Microsoft Front Page adds value to create web application by adding the visual components that's missing from Visual InterDev.

It provides a WYSIWYG environment for editing pages that does not require any programming knowledge and skills. Therefore, users can quickly generate HTML by using Microsoft Front Page. A lot of time is saved and frustration spent on getting complicated HTML page layout is properly adjusted. In addition, it also supports many modern technologies, such as HTML 4.0, Cascading Style Sheet (CSS), ActiveX Controls, JavaScript, VBScript, theme and Dynamic HTML effects.

3.3.5.3 Macromedia Dreamweaver MX

Macromedia Dreamweaver MX is a program for conducting and managing Web sites where at its core is HTML, a language containing a series tag that defines the structure of a Web page. It is a deceptively easy tool to develop and manage any web site or Internet application whether it is built with HTML, XHTML, XML, Web services, ColdFusion, ASP.NET, ASP, JSP or PHP.

A powerful tool, but also an industrial-strength application and making it a favorite among Web design professional. It supports cross platform development environment for J2EE and .NET. It has built-in functionality and can be as easy or as complex as we desire. It also enhances coding features such as code hints, color-coding, code validation and tag editors by providing a complete control over code and design.

However, there are some limitations when working in layout view. It is not possible to insert a layer on your page and to convert from tables to layers when working in layout view.

3.3.6 DATABASE MANAGEMENT LANGUAGE

3.3.6.1 MySQL

MySQL is a true multi-user, multi-threaded SQL database server. It is an Open Source (GPL) Standard Query Language (SQL) database that is fast, reliable, easy to use and suitable for applications of any size.

MySQL can easily be integrated into Perl programs by using the Perl DBI (DataBase Independent interface) module. DBI is an Application Program Interface (API) that allows Perl to connect to and query a number of SQL databases. In addition to supporting standard SQL (ANSI), it compiles on a number of platforms and has multithreading abilities on UNIX servers. For non-Unix people, MySQL can be run as a service on Windows NT and as a normal process in Windows 95/98 machines.

It is relatively clean where no huge grammar quirks, simple privilege administration. It does not have a slew of administrative tasks to put up, so it is easy to maintain and upgrade.

3.3.7 WEB SERVER

A Web server is a computer and associated software that is attached full time to the Internet.

3.3.7.1 Apache Web Server

As an open source Web-server, the Apache server benefits from many contributions from web developers. It is available in the form of modules and is supported in many commercial distributions. It is also available on many platforms in both binary and

source code format and has earned the reputation of being the most reliable Web server available.

It is a freeware available at www.apache.org, reliably and quietly serves more than 60 percent of the currently posted websites. It provides cross-platform support where Apache can run on Windows, OS/2 and all the major variants of UNIX. Moreover, it complies with the newest level of the Hypertext Transport Protocol, HTTP 1.1. Free support is provided through a bug reporting system and several Usenet newsgroups.

The weaknesses of this server are: lacking of visuals, wizards and/or browser based administration tools and more extensive technical support requires the purchase of third party supports.

3.3.7.2 Microsoft Internet Information Server

Microsoft Internet Information Server (IIS) provides a transactional-based Web server that is tightly integrated with Microsoft's Windows NT and Windows 2000 Server operating systems. With IIS, Microsoft includes a set of programs for building and administering Web sites, a search engine and support for writing Web-based applications that access databases. Microsoft also includes special capabilities for server administrators designed to appeal to Internet service providers (ISPs).

The advantages of IIS can be separated into two camps, which are the additional functionality in managing and developing application functionality and the improvement in HTTP-related service areas. The advancement for the application development side includes transactional-based applications, process isolations, ActiveX Data Object (ADO) and new development tools. While the advancements in

the HTTP services area enable IIS to manage multiple Web sites, tailor site or application specific settings.

IIS is a well-integrated server administration tools that provides a high-speed, secure platform for publishing information on internal networks or Internet. It is easy to configure to enable multiple machines to share the load and deliver more reliable web services. The Transactional Active Server Page feature of IIS allows application with scripts and components to perform multiple actions. IIS will automatically backs up the server to the start of the transaction if a failure occurs during a particular transaction.

3.3.8 WEB BROWSER

Web browsers are the main GUIs for communicating with the Internet and the Web. Browsers locate Web sites and pages via their unique URLs and display their contents to let user to view and explores information on the web.

3.3.8.1 Microsoft Internet Explorer

Microsoft Internet Explorer (IE) is one of the major browsers that Internet users utilize to navigate the Web to view WWW documents and access the Internet taking advantage of text formatting, hypertext links, images, sounds, motion and other features. It comes with the Microsoft Windows operating system and can also be downloaded from Microsoft's Web site. The customizing and the setup parameters of IE are found in the sequence *Tools => Internet Options*.

Internet Explorer 6.0 is the standard browser in the latest version of Windows (Windows XP). It includes Outlook Express as its e-mail tool, provides a flexible,

private and reliable browsing experience of the Internet for users of Windows Millennium Edition (Windows Me), Windows 2000 Professional, Windows 98 and Windows 98 Second Edition and Windows NT® 4.0 Workstation.

3.3.8.2 Netscape

Nowadays, Netscape is one of the two most popular Web browsers that Internet users used to serve the Web. It is now part of America Online (AOL). Netscape, as well as Internet Explorer are currently the leading "graphical browsers" in the world. This means that they facilitate the viewing of graphics such as images and video and more. Besides that, it offers the ability to e-mail documents, download them to diskette, print them and keep track of where user has been and sites that user wants to "bookmark". Netscape was the predominant product in terms of usability and number of users at the beginning, but Microsoft's browser is generally considered superior by many users and it has taken a significant lead in usage.

Netscape's browser was called "Navigator". It was developed by a team led by Marc Andreessen in 1995, who created Mosaic, the first Web browser that had a graphical user interface. The latest version of the Netscape browser can be downloaded from Netscape's Web site at no charge. The customizing and the setup parameters of Netscape Communicator are found in the sequence *Edit => Preferences*. On the other hand, Netscape has a smart browsing feature and its Netcenter that are useful for searching the Internet.

3.3.8.3 Opera

Opera is a Web browser that provides some advantages over the two most popular browsers- Microsoft Internet Explorer and Netscape Communicator. Much smaller in size, Opera is known for being fast and stable. It offers the same capabilities of the more popular browsers including integrated searches and instant messaging, support for JavaScript, cascading style sheets (CSS) and mail.

Opera is free for downloading to all supported platforms. It is available for a number of operating systems such as BeOS, Linux, Mac OS, Solaris, Symbian OS and Windows. However, it is being promoted for use in hand-held Internet devices because it is so compact.

3.4 SUMMARY

This chapter has reveals the strengths and weaknesses of each system development model, which is important in making a justification on selected software process model. As a result, the V Model has been chosen as a guideline throughout the life cycle of E-Thesis.

Besides that, information is also collected on the recent software technology. Then, a decision will be making to choose the most feasible development tools to implement E-Thesis based on the comparison of each features. An appropriate software model and suitable development tools will define the successful of the project.

CHAPTER 4: FINDING (ANALYSIS AND EVALUATION)

4.1 INFORMATION GATHERING METHOD

➤ 4.1.1 Internet Research

Internet is the main resource to search for information that related to Plagiarism Detector. Internet Research offers more valuable information than any other information gathering method by providing a wide range of electronic media or sources such as online articles, online journals, online directories and etc. The new breed fact-finding technique provides helpful alternative to search information and gain knowledge required in the development cycle. Major search engines such as Google, Excite and Yahoo enable relevant information sites to be viewed easily. The review of the existing system from the internet also provides the important information to know the common and the different features of the existing systems.

➤ 4.1.2 Discussion With Supervisor

Discussions have been made with supervisor from time to time for smoothing out the progress of project. Further details and idea on how to develop Plagiarism Detector are gained from discussion. Furthermore, supervisor also gives advices, guidance and supports to explore more advance knowledge and to improve project performance.

➤ 4.1.3 Conversation with Friends

Informal conversation with friends would be able to get the opinions from the point of view of a system user to get extra information. Each person will probably have a different view of Plagiarism Detector because each person will interact with the

system differently when it is built. Therefore, the data collected and reported by the system addresses the needs of vary users.

4.2 FUNCTIONAL REQUIREMENTS

A functional requirement describes an interaction between the system and its environment. Therefore, it is a statement of the services or functions that Virtual Reality Application for Hypermarket should provide, how the system reacts to particular inputs and how it should behave in particular situation [Sommerville, 1995]. Further function requirement also describes how the system shown behaves given the certain stimuli. Modules are incorporated and integrated into the system with details during the analysis of functional requirements.

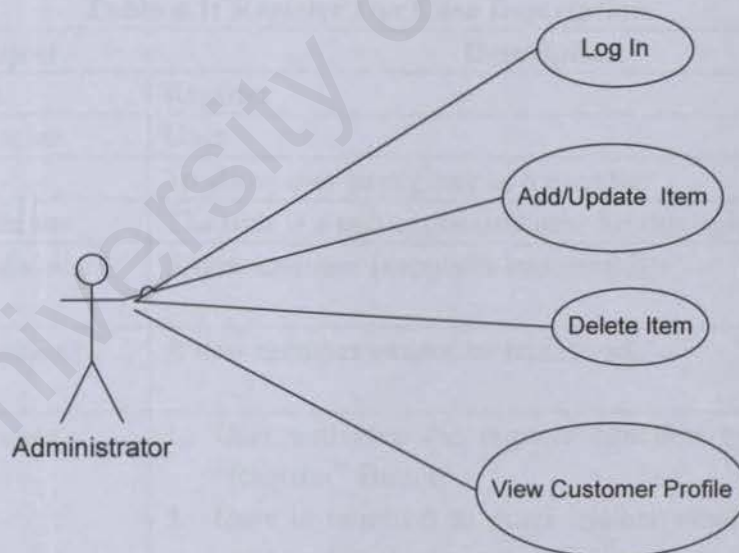
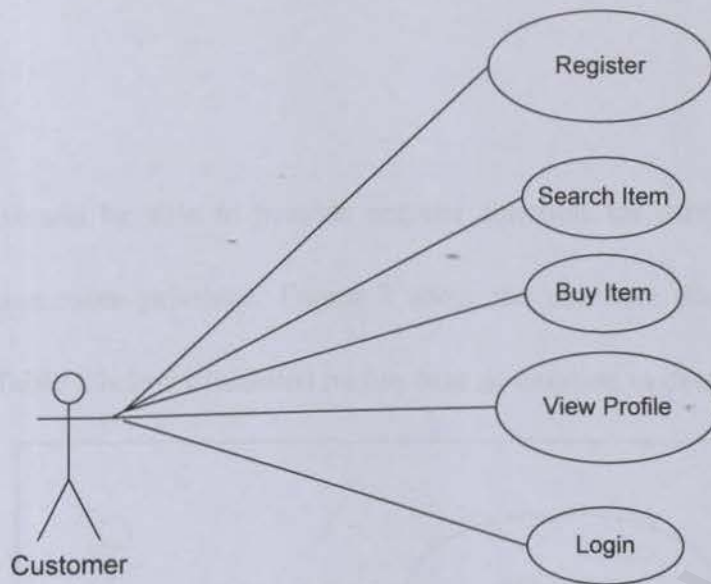


Figure 4.1: Use Case Diagram of Virtual Reality Application for Hypermarket

4.2.1 User

Register

This system should be able to provide register function for user to register as a member to have more privilege. Figure 2 show the use case diagram of register function and Table 1 below illustrated its use case description in details.

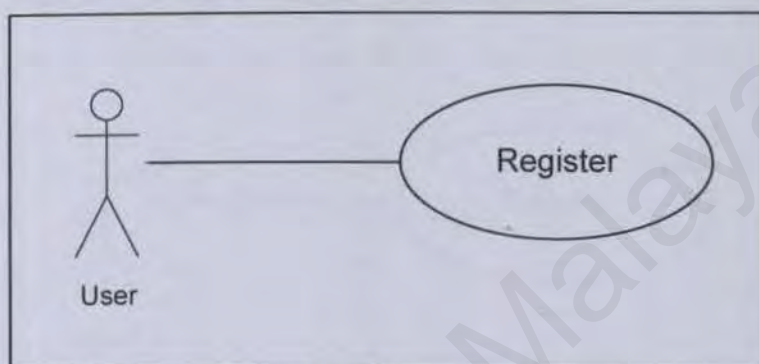


Figure 4.2: Use Case Diagram of Register

Table 4.1: Register Use Case Description

No	Subject	Description
1.	Use Case	Register
2.	Primary Actor	User
3.	Goal	To allow user to register as a member.
4.	Pre-conditions	The user is a non-registered user for this system
5.	Post-conditions (success)	A new member is register successfully.
6.	Post-conditions (failure)	A new member cannot be registered.
7.	Main Success Scenario	1. User activates the register function by clicking on "Register" Button. 2. User is required to enter his/her email address and password for login to the system after registered. 3. Once the user click on save button, the new member information will add to the database
8.	Extensions	2a. If the email address entered by the user is existed in database, user is required to use another email address.

Search

This system should be able to provide search file function for user to search the files which are needed in the database. User can search the files based on the keywords of the files they needed. Figure 3 show the use case diagram of search function and Table 1 below illustrated its use case description in details.

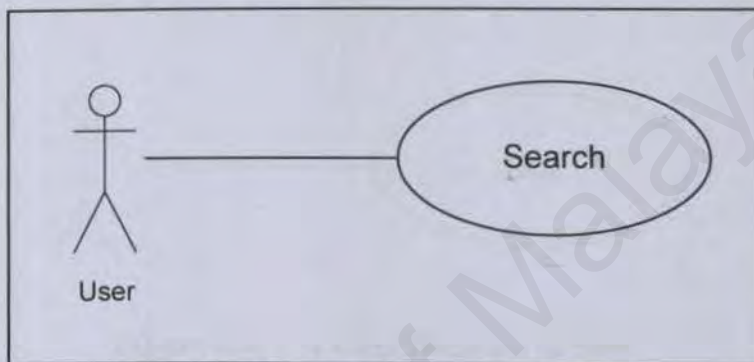


Figure 4.3: Use Case Diagram of Search

Table 4.2: Search Files Use Case Description

No	Subject	Description
1.	Use Case	Search
2.	Primary Actor	User
3.	Goal	To allow user search files which stored in the database
4.	Pre-conditions	The user is a registered or non-registered user for this system
5.	Post-conditions (success)	Related file information will be returned to the user.
6.	Post-conditions (failure)	No file information is returned to the user.
7.	Main Success Scenario	1. User search the specify file by using file properties - keywords. 2. All of the files, either partially match or fully match will be returned to the user.
8.	Extensions	2a. No file will be returned if no match in database.

Buy

This system should be able to provide buy function for user to buy the things. User can anything in the system that show to everyone. Figure 4 show the use case diagram of buy function and Table 3 below illustrated its use case description in details.

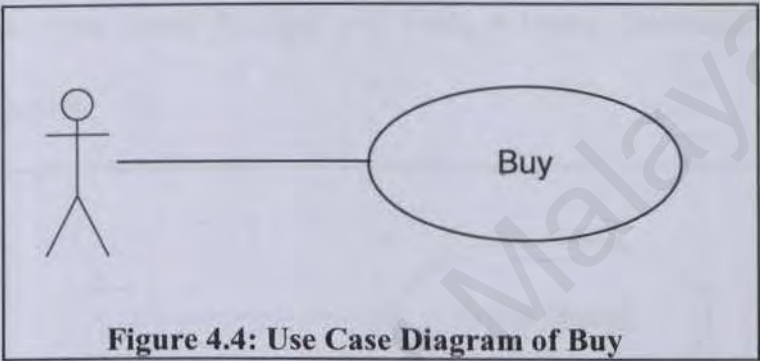


Table 4.3: Buy Items Use Case Description

No	Subject	Description
1.	Use Case	Buy
2.	Primary Actor	User
3.	Goal	To allow user buy thing through the system
4.	Pre-conditions	The user is a registered or non-registered user for this system
5.	Post-conditions (success)	User can buy the things.
6.	Post-conditions (failure)	Failure to buy things.
7.	Main Success Scenario	1. User adds the things in to shopping cart.
8.	Extensions	2a. No any extensions.

View Result

This system should be able to provide view result function for user to view the files information after operate the search function. The file information which will be display is the location of the files and keywords of the files. Figure 5 show the use case diagram of view result function and Table 4 below illustrated its use case description in details.

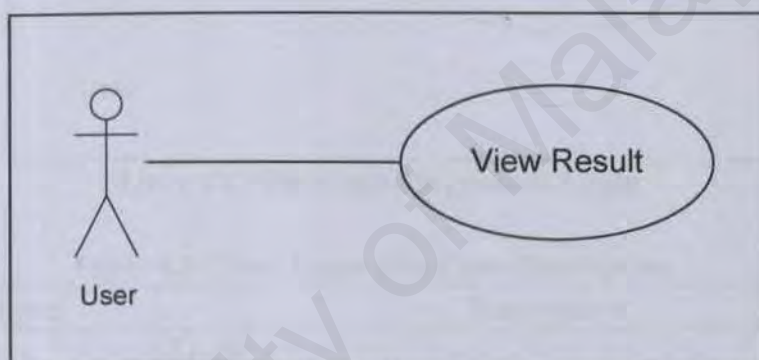


Figure 4.5: Use Case Diagram of View Result

Table 4.4: View Result Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	View Result
2.	<i>Primary Actor</i>	User
3.	<i>Goal</i>	To allow user view the information of the files related with the keywords entered after operating search function.
4.	<i>Pre-conditions</i>	The user is a registered or non-registered user for this system
5.	<i>Post-conditions (success)</i>	The files information and the percentage of VR application displayed after operating search function.
6.	<i>Post-conditions (failure)</i>	No information display after the search function is operated.
7.	<i>Main Success Scenario</i>	1. The files information which included the location of the files and keywords of the files from the search result displayed.
8.	<i>Extensions</i>	1a. No information display from the search result.

Login

This system should be able to provide login function for user to login to the system.

Figure 6 show the use case diagram of login function and Table 5 below illustrated its use case description in details.

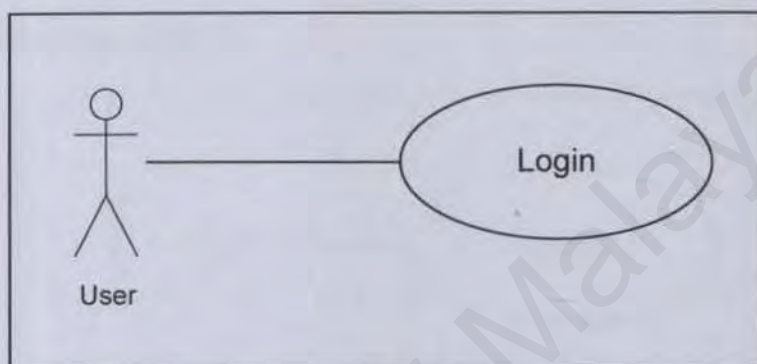


Figure 4.6: Use Case Diagram of Login

Table 4.5: User Login Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	Login
2.	<i>Primary Actor</i>	User
3.	<i>Goal</i>	To allow user to login to the system.
4.	<i>Pre-conditions</i>	The user is a registered user for this system
5.	<i>Post-conditions (success)</i>	A member is login to the system successfully.
6.	<i>Post-conditions (failure)</i>	A member cannot login to the system.
7.	<i>Main Success Scenario</i>	1. The user input their email address and password in the related fields. 2. User activate the login function by clicking on the "Login" button
8.	<i>Extensions</i>	3a. The system will not proceed to other pages if the user unable to input the correct email address and password

4.2.2 Administrator

Login

This system should be able to provide login function for admin to login to the system.

Figure 7 show the use case diagram of login function and Table 6 below illustrated its use case description in details.

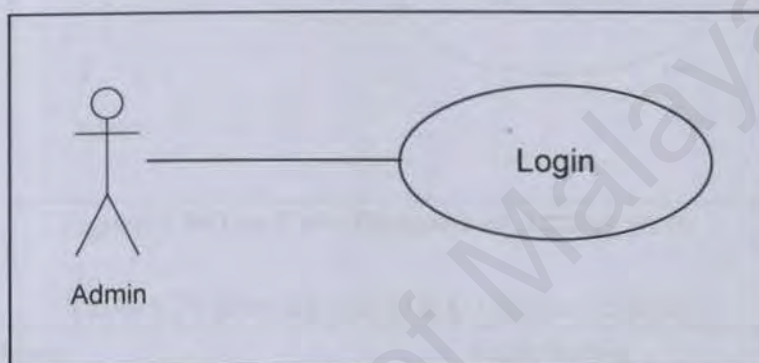


Figure 4.7: Use Case Diagram of Login

Table 4.6: Admin Login Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	Login
2.	<i>Primary Actor</i>	Admin
3.	<i>Goal</i>	To allow admin to login to the system.
4.	<i>Pre-conditions</i>	The people is the stuff of the hypermarket
5.	<i>Post-conditions (success)</i>	An admin is login to the system successfully.
6.	<i>Post-conditions (failure)</i>	An admin cannot login to the system.
7.	<i>Main Success Scenario</i>	The admin enter their username and password correctly.
8.	<i>Extensions</i>	The system will not proceed to other pages if the admin unable to input the correct username and password

Add/Update

This system should be able to provide add/update function for admin to insert the data of items or goods into the database. Figure 8 shows the use case diagram of add/update function and Table 7 below illustrated its use case description in details.

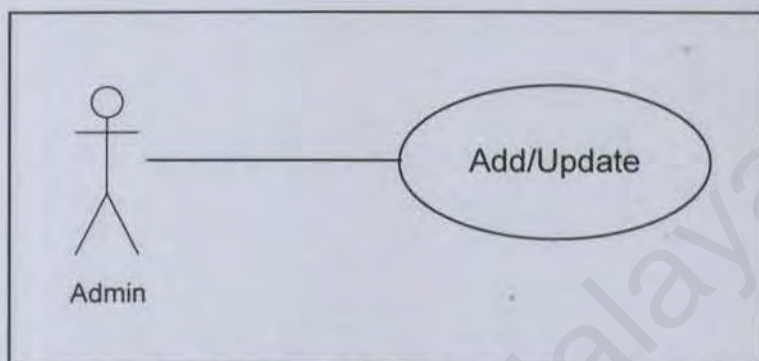


Figure 4.8: Use Case Diagram of Add/Update

Table 4.7: Add/Update Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	Add/Update
2.	<i>Primary Actor</i>	Admin
3.	<i>Goal</i>	To allow admin insert the data of items or goods into the database
4.	<i>Pre-conditions</i>	The people is the stuff of the hypermarket
5.	<i>Post-conditions (success)</i>	An admin is adding /updating the data successfully
6.	<i>Post-conditions (failure)</i>	An admin cannot add /update the data
7.	<i>Main Success Scenario</i>	The admin enter their username and password correctly in the login page.
8.	<i>Extensions</i>	The information entered by admin cannot be captured by the system.

Delete

This system should be able to provide delete function for the admin to delete the data.. Figure 9 show the use case diagram of delete files function and Table 8 below illustrated its use case description in details.

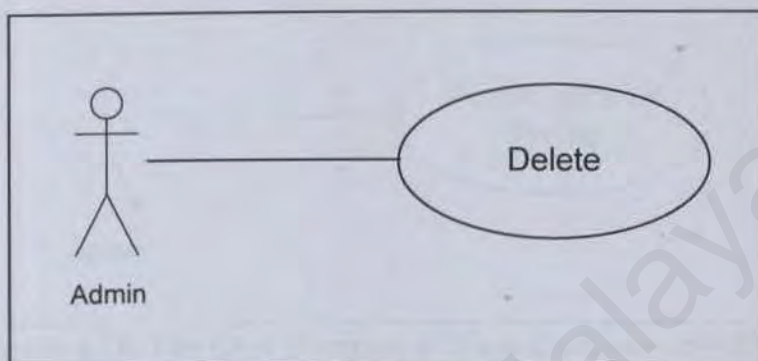


Figure 4.9: Use Case Diagram of Delete

Table 4.8: Delete Files Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	Delete
2.	<i>Primary Actor</i>	Admin
3.	<i>Goal</i>	To allow admin to delete data.
4.	<i>Pre-conditions</i>	The people is the stuff of the hypermarket
5.	<i>Post-conditions (success)</i>	The data which is saved in the database are deleted successfully.
6.	<i>Post-conditions (failure)</i>	The data which is saved in the database cannot be deleted.
7.	<i>Main Success Scenario</i>	Admin activates the delete function.
8.	<i>Extensions</i>	The file which is chosen to delete cannot be deleted

View Customer Profile

This system should be able to provide view customer profile function for the admin to view the data of the user. Figure 10 show the use case diagram of view customer profile function and Table 9 below illustrated its use case description in details.

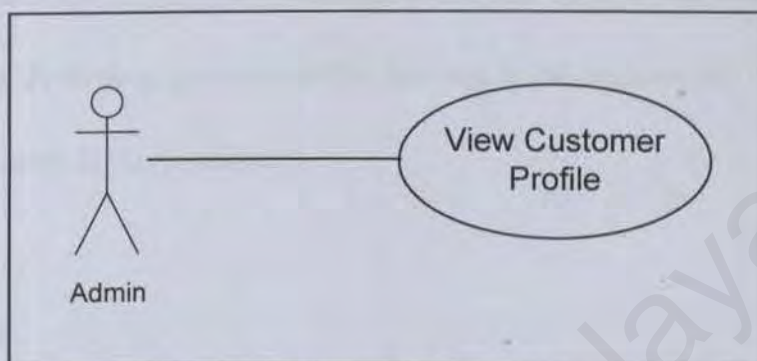


Figure 4.10: Use Case Diagram of View Customer Profile

Table 4.9: Admin Delete Files Use Case Description

No	Subject	Description
1.	<i>Use Case</i>	View Customer Profile
2.	<i>Primary Actor</i>	Admin
3.	<i>Goal</i>	To allow admin to view the user/customer profile.
4.	<i>Pre-conditions</i>	The people is the admin of the hypermarket
5.	<i>Post-conditions (success)</i>	The user/customer profile can view by admin.
6.	<i>Post-conditions (failure)</i>	The user/customer profile cannot view by admin.
7.	<i>Main Success Scenario</i>	The admin enter their username and password correctly.
8.	<i>Extensions</i>	The user/customer profile will not appear.

4.3 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirement are the constraints and restrictions under which the system must operate and the standards which must met by the delivered system. It describes a restriction on the system that limits one choice for constructing a solution to the problem. Following are some of the non-functional requirement of the Virtual Reality Application for Hypermarket:

4.3.1 Usability

This system should be easy-to-use and easy-to-learn for all users wheater their computer knowledge level is high or low. The system design should be simple and understandable for users. Therefore the users can easily learn how to use the system without attending any training and the using of such system will not cause pressure to user such as ease of memorizing the steps taken to perform any facility and the web pages navigation.

4.3.2 .Performance

The system should be able to respond fast and accurately after receiving users' request. The search result with the percentage of plagiarism should be showed with accurately within 10 seconds after receiving the request from user. The upload file process should be able done within 10 seconds.

4.3.3 Reliability

The system should be available all the time. The system failure should be able to be fixed within a day and the failure should not affect to other functions in the system such as the failure in upload file function should not affect the search function. The system must also be stable where it must not be easily crashed.

4.3.4 Portability

The system should be able to access by all the users at any time and any place by using a personal computer or laptop with internet access and there is Internet browser installed in the machine.

4.3.5 Maintainability

The system maintenance will required more efforts if the system is not designed according to good programming practices. The system design and the system function coding should be created follow a standard such as the function naming standard so that the code is easy to understand and trace for the future maintenance of the system can be done easily. If the system errors occurred, it should also be able to correct easily within a short period and if the user requirement is changed, it should be able to enhance easily.

CHAPTER 5

SYSTEM DESIGN

System design is done in order to determine the features of the system, components and processes in a system and as appearance to the users. System requirements defined in the previous chapter are translated into a system specification to build complete and executable "Virtual Reality Hypermarket Application".

Design is a creative process of transforming the problem into a solution, the description of a solution is also called design. The reasons of doing the system design are shown as below:

- Detailed design specification with specific logical design elements that describe features of a system such as input, output, database and process.
- Meet user requirement in terms of appropriate procedures performance, proper form presentation, accurate and reliable results and appropriate of interaction method.
- Build on easy-to-use application with specific design that required favorable human engineering, physically comfortable and contributes to user's effectiveness.
- Confirm a design and specification that is accordance to prescribed rules and practices of a system.

Design phases focus both on the logical and physical or technical aspects of the system. Using the information obtained from the system analysis phase, the designers propose a new system that will solve the users' processing problems or meet their current and future needs. The design phase synthesizes the various parts into a variable, working system. The design will include database, function or process and other dynamic aspects of the system. The design will specify how the various functions will be integrated as well as the input or output design and interface design.

5.1 Conceptual and Technical Design

To transform requirements into a working system, designers must satisfy both customers and system developers. The customers understand what the system is to do.

At the same time, the system developers must understand how the system is to work. For this reason, design is really a two-part interactive process. First, a conceptual

design or a system design that tells the customers exactly what the system will do is produced. Once the customer approves the conceptual design, it is translated into much more the actual hardware and software needed to solve the customer's problem.

5.1.1 Conceptual Design

The conceptual design describes the system in language that the customer can understand, rather than in computer jargon and technical terms. For example, the customer may be told what a menu on a display screen will give users access to the system functions. The conceptual design may even list acceptable user responses and the actions that may result. However, the customer is not told how the data are stored or what kind of database management system will perform data manipulation.

A good conceptual design should have the following characteristic:

- It is written in the customer's language
- It contains no technical jargon
- It describes the functions of the system.
- It is independent of implementation.
- It is linked to the requirement documents.

In other words the conceptual design enables the customer to understand what the system will do by explaining the observable external characteristics of the system.

5.1.2 Technical Design

The technical design describes the hardware configuration, the software needs, the communications interfaces, the input and output of the system, the network architecture, and anything else that translates the requirements into a solution to the customer's problem. That is, the technical design description is a technical picture of the system specification. It usually includes at least the following items.

- A description of the major hardware components and their functions.
- The hierarchy and function of the software components.
- The data structures and the data flow.

5.1.3 System Architecture

Virtual Reality Hypermarket Application is considered two-tier architecture actually has three parts a client, a server, and a protocol. The protocol bridges the gap between the client and server tiers. The two-tier design is very effective for network programming as well as for GUI program in which you can allocate functionality to the host.

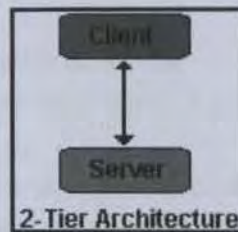


Figure 5.1 System Architecture

5.2 System Structured Chart

Structured charts are used during architectural design to document hierarchical structure, parameters and interconnection in a system. A structure chart differs from a flow chart in two ways, a structure chart has no decision boxes, and the sequential ordering of tasks inherent in a flow chart can be expressed in a structure chart.

Below is the structured chart of the application system.

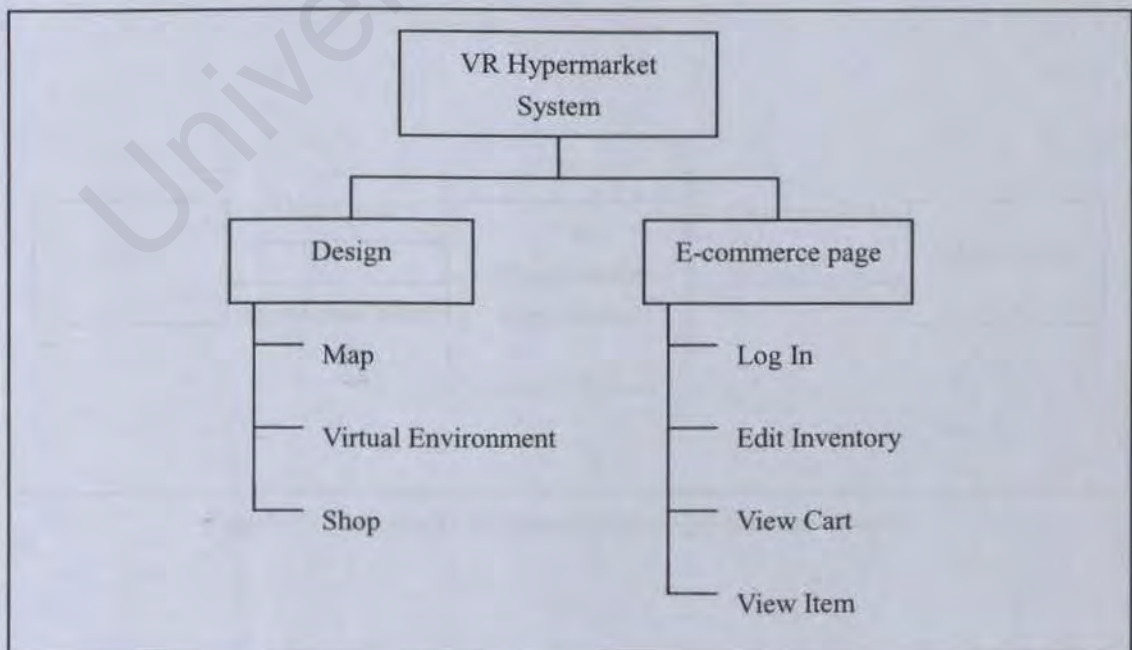


Figure 5.2: Structured chart of the application system

5.3 Data Flow Diagram

Data Flow Diagramming is a means of representing a system at any level of detail with a graphic network of symbols showing data flows, data stores, data processes, and data sources destination. The data flow approach emphasizes the logic underlying the system. The purpose of data flow diagram is to provide a semantic bridge between users and system developers. The diagrams are:

- Graphical, eliminating thousands of words
- Logical representations, modeling what a system does, rather than physical models showing how it does it.
- Hierarchical, showing systems at any level of detail
- Jargon less, allowing user understanding and reviewing.

The goal of data flow diagramming is to have a commonly understood model of a system. The diagram are the basis of structured system analysis such as data structure diagrams, data dictionaries, and procedure-representing techniques such as decision tables, decision trees, and structured English.

Below are the Data Flow Diagrams:

DFD: Context Diagram

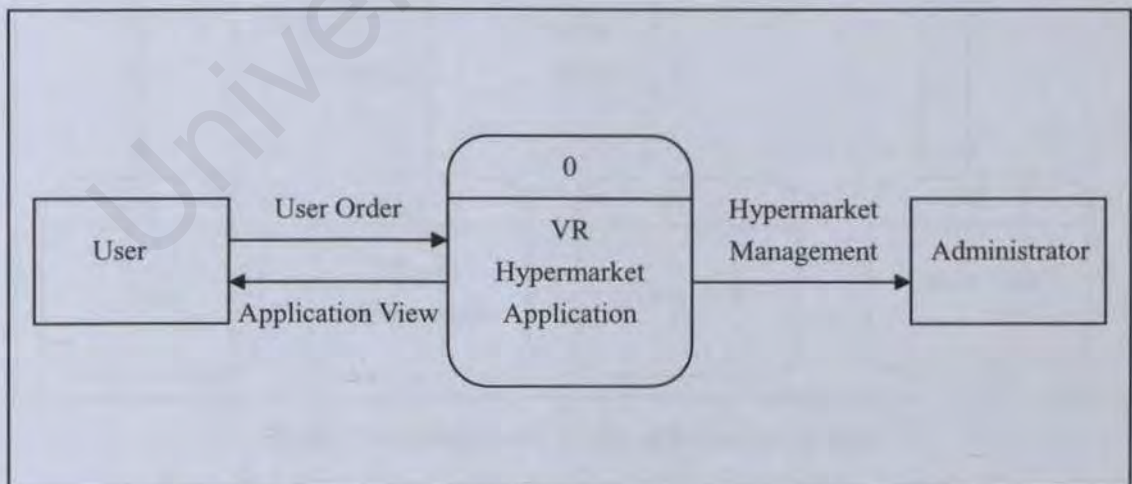


Figure 5.3: Context Diagram of the application system

DFD: Level-0

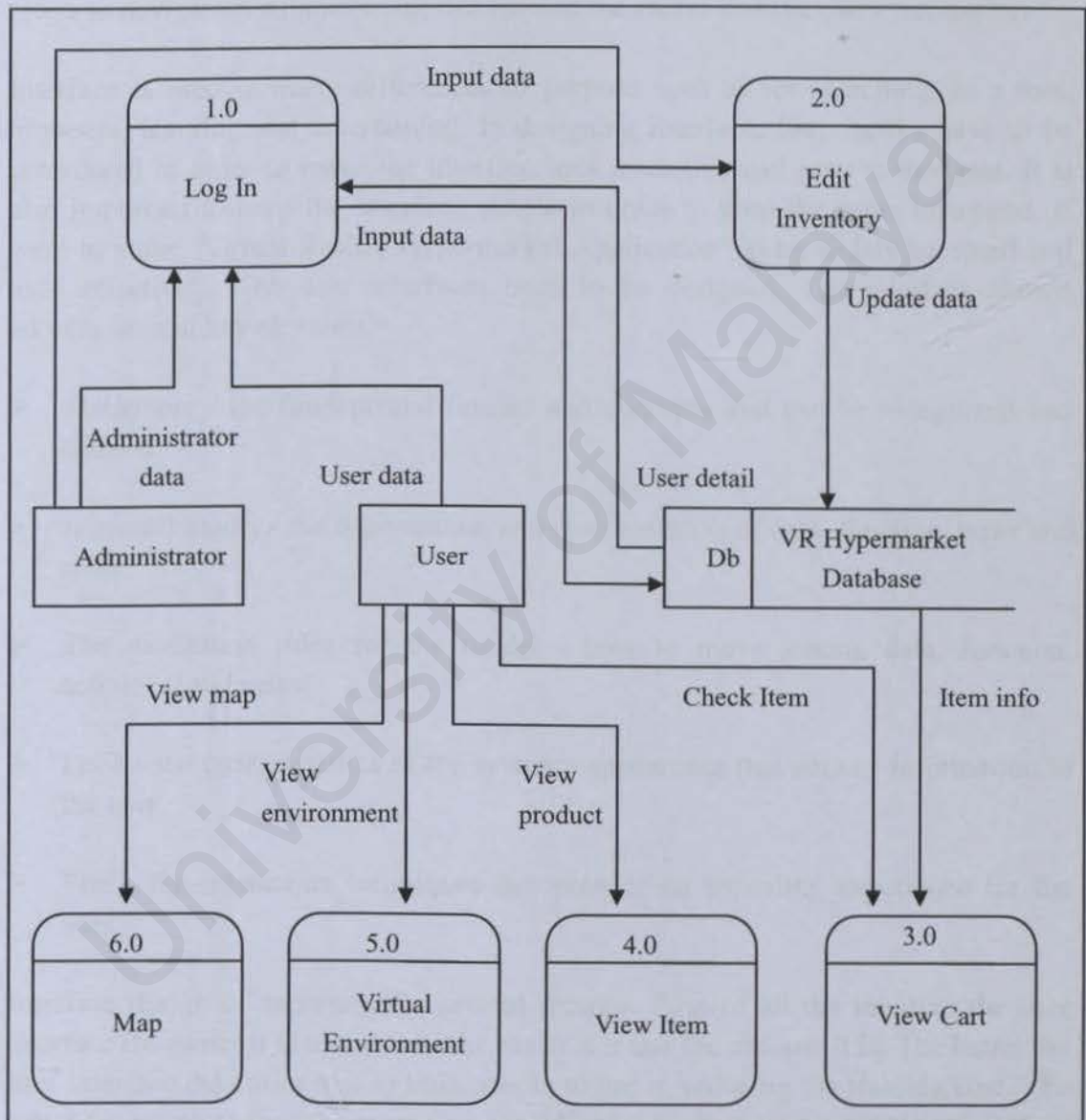


Figure 5.4: Diagram 0 of the application system

5.4 User Interface Design

The interface is the infrastructure of the application. All online and offline web sites and application have an infrastructure that like the component parts together so that users understand what is contained in the system, how the information is organized, and what they need to do activate the separate pieces. An analog that is often used refers to navigation within the application and the routes that the users can explore.

Interface is used in many different purposes such as for searching, as a tool, browsers, learning and entertaining. In designing interface, four factors have to be considered in order to make the interface look attractive and easy to navigate. It is also important to keep the interface simple in order to keep the users interested. If we want to make "Virtual Reality Hypermarket Application" to be widely accepted and used effectively. The user interfaces need to be designed. The interface should address several key elements:

- Metaphors - the fundamental images and concepts that can be recognized and learned.
- A mental model - the organization and representation of data, function, tasks and roles.
- The navigation rules for the model - how to move among data, function, activities, and roles.
- Look - the characteristics of the system's appearance that convey information to the user.
- Feel - the interaction techniques that provide an appealing experience for the user.

Interface design is important for several reasons. First of all the intuitive the user interface the easier it is to use, and the easier it is to use the cheaper it is. The better the user interface the easier it is to train people to use it, reducing the training cost. The better the user interface the more users will like to use it, increasing their satisfaction with the system.

5.5 Template and 3D View

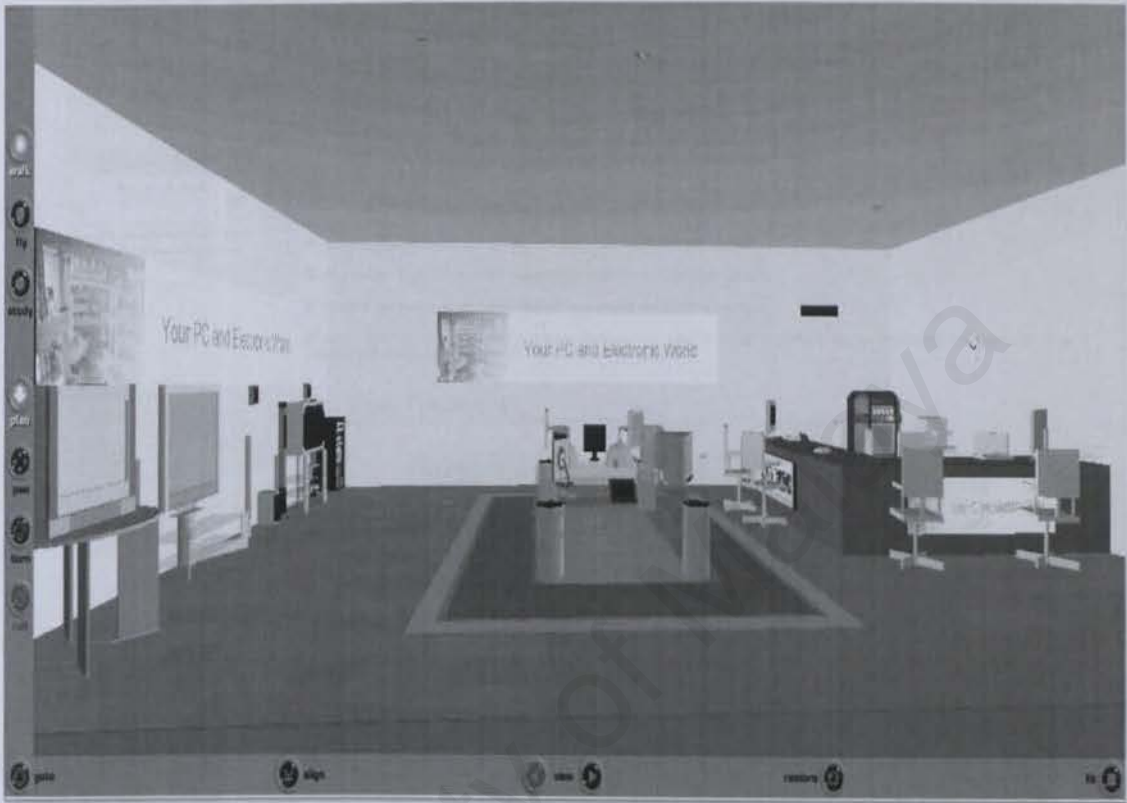


Figure 5.5: 3D View



Figure 5.6: Home Template (prototype)

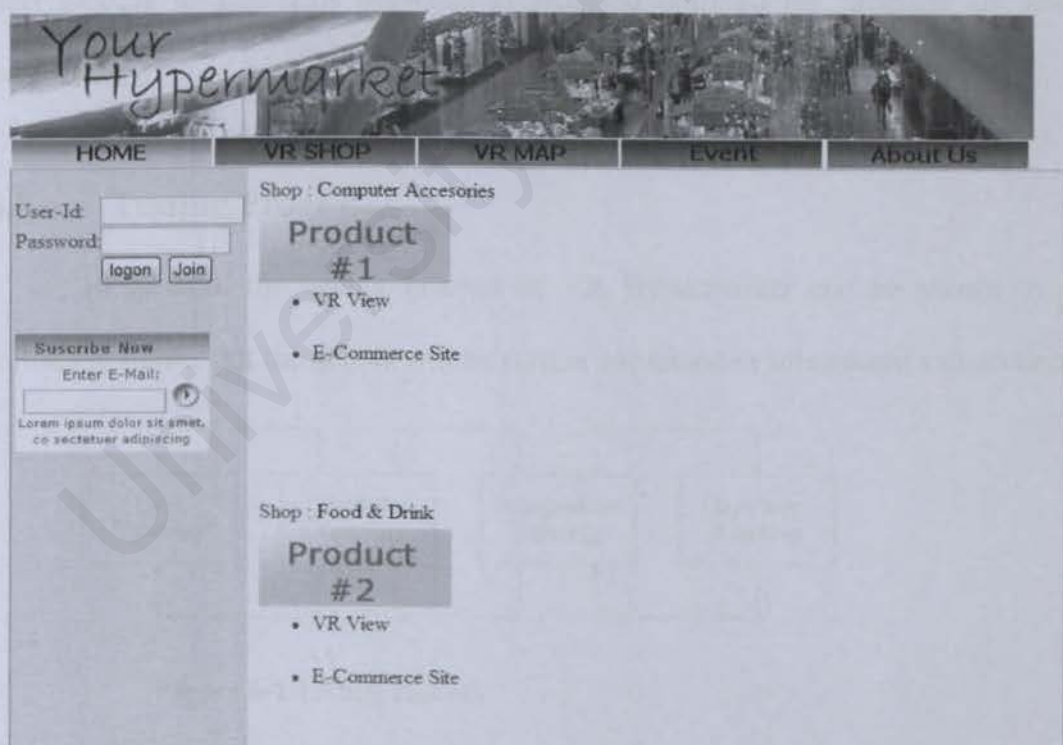


Figure 5.7: VR Shop Template (prototype)

Chapter 6 –SYSTEM TESTING

6.1 Introduction

The main function of testing is to establish the presence of defects in a program and to judge whether the program is usable in real application. Nevertheless, testing can only demonstrate the presence of errors. It cannot show that there is no error in the program. Therefore, a more suitable approach must be chosen to reduce the possibility of errors in a program.

Bottom-up approach is adopted in system testing for “Virtual Reality Application for Hypermarket”. Each module at the lowest level of the system hierarchy is tested individually. Then, all the tested modules would be related to the next module testing. This approach is repeated until all the modules are tested successfully.

6.2 Testing Process

In general, the testing process of VR Hypermarket can be shown in the following figure. All the details will be further explained in subsequent sub-sections.

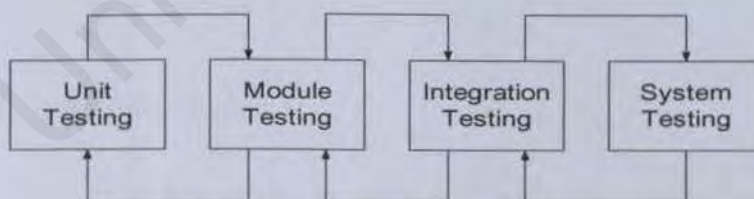


Figure 6-1 Testing Process

6.2.1 Types of Testing

6.2.1.1 Unit Testing

- Unit test is the process to test the individual component to ensure that they function properly. Each component is tested independently without the

interference from other system components. Unit test is performed concurrently with the development process.

- Techniques used during the process of performing unit testing are as follows:
 - Code Review

Before a .wrl file is compiled into VRML, codes are reviewed line by line to discover any syntax error as well as semantic error. If errors are discovered, they are corrected immediately.
 - Compilation of VRML

This method is faster compared to code review techniques and it is efficient in discovering errors. During the compilation, the VRML compiler will detect type of errors in a program and display the error type as well as the line number in which the error occurs.
 - Other techniques

The images that use to texture to the objects are usually save in a same folder. This is because to avoid the different directory in different PC. If not the image will be become invisible and cannot view by the user.

6.2.1.2 Module Testing

Module testing is performed without other system modules. A module consists of a collection of dependent components to perform a particular task or function. Different possible test cases are applied to the module and the test results would be verified. Unusual results will be analyzed and they would help in debugging sub-modules in order to produce the desired output.

6.2.1.3 Integration Test

Integration test is needed when all modules are integrated. The main focus in integration test is to navigate the interfaces repeatedly to detect any interface mismatch problem.

Several important aspects are checked to ensure that the flow of the data in VR Hypermarket is well organized and are user friendly to all the system users.

6.2.1.4 System Test

The sub-systems are integrated to make the entire system. Therefore, the main purpose in system testing is to find errors that result from unanticipated interactions between sub-systems. Besides, it is used to validate whether the system meets its functional and non-functional requirement.

Problems might occur by the time the new developed system is integrated to existing system. There are few possibilities that might lead to this mismatch of both new and old system

- Interface mismatch

As VR Hypermarket is a totally separate system, VR Hypermarket has its own set of interfaces. Therefore, no interface mismatch occurs. The virtual environment is embedded in the .html interface. Therefore, no interface mismatch occurs.

- Data type mismatch

VR Hypermarket has its own database to store data needed to handle the systems operation. Besides that, for the beginning stage, administrator'

personal information including their login name, and password are retrieved from the same database.

Finally, a performance test is performed to compare the integrated modules with the non-functional system requirements. These requirements include security, interoperability, flexibility and reliability.

6.3 Conclusion

Testing on a system had been done successfully. Testing is important for ensuring the functionality of the system of the system has run correctly follow the user requirement.

Chapter 7 - System Implementation

7.1 Introduction

System implementation in software development is a process to convert system requirements into program codes. The initial stage of system implementation involves setting up the development environment. This includes setting up development tools to facilitate the system implementation.

Generally, the development environment is suited according to different development phases, which can be categorized into system design, system development and report writing process.

7.1.1 System Design

Although system design is clearly stated in chapter 5, nevertheless, during the initial stage of system development, a number of considerations and adjustments were done to the initial system design in order to match the actual needs and requirements.

7.1.2 System Development

The basic tools used for the system development are:

- i. VRML Pad
- ii. SQLyog
- iii. Appserv
- iv. Room Arranger
- v. 3D Studio Max
- vi. Adobe Photoshop 7.0 (Image creation Tool)
- vii. Macromedia Dreamweaver MX (Editor and interface creation tool)
- viii. Macromedia Flash MX (Banner Creation Tool)
- ix. Microsoft Internet Explorer 6.0 (Web browser)

7.1.3 Report Writing

All the problems encountered, together with solutions found throughout the processes (from system implementation until system evaluation) were recorded as well as result from system testing and system integration.

7.2 System Coding – Coding Approach, Style and Scripting Language

7.2.1 Database Implementation

For “Virtual Reality Application for Hypermarket (VR Hypermarket)”, the database is stored in a PC in which SQLyog was installed. SQLyog is compatible with MySQL 4.1.7. Any data creation, updates or data retrieval will be connected directly to the database server through MySQL.

The database includes tables to keep users’ details including users’ authentications information. VR Hypermarket is an application that mixes e-commerce and 3D virtual environment together. After the VR Hypermarket is completed and tested successfully, all the raw data were flush from the database. All the unnecessary tables were eliminated from VR Hypermarket database to avoid data overlapping and to reduce workload of the entire system when deployment.

7.2.2 Application Server Configuration

The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows NT. The goal of this project is to provide a secure, efficient and extensible server that provides HTTP services in sync with the current HTTP standards.

Apache has been the most popular web server on the Internet since April 1996. The November 2005 [Netcraft Web Server Survey](#) found that more than 70% of the web sites on the Internet are using Apache, thus making it more widely used than all other web servers combined.

7.2.3 Program Implementation

7.2.3.1 Coding Approach

Top-down approach is chosen to break the big modules of VR Hypermarket into functions and procedures. All these small modules or functions are built and developed separately. In the beginning stage, all the java classes are designed using object-oriented methodology

7.2.3.2 Coding Style

PHP and HTML is used to develop the entire VR Hypermarket (while the virtual environment is using room arranger to generate the VRML code), with the php open source code. To increase the coding readability and to help in future enhancements, a page is formed by small pieces of files through the use of "require_once". This is very important as it reduces workload of system developers especially when they make changes on the layout of interfaces. Besides, it also enables system to be developed in shortest time as it allows few developers to work on separate modules at the same time.

PHP Page

A PHP page is formed by small pieces of files. Figure 7-1 indicated a PHP page (index.php), as all the pages include a several file of .php by using "require_once". Therefore, whenever there are changes in the header part, all the pages will be updated at the same time. This simplifies work done during correction or updates on pages.

By using PHP class, the concept of inheritance and encapsulation can be manipulated thus it enhances class reusability that can lead to easier system expandability.

```
<?php
require_once 'library/config.php';
require_once 'library/category-functions.php';
require_once 'library/product-functions.php';
require_once 'library/cart-functions.php';
```



```

$_SESSION['shop_return_url'] = $_SERVER['REQUEST_URI'];

$catId = (isset($_GET['c']) && $_GET['c'] != '1') ? $_GET['c'] : 0;
$pdId = (isset($_GET['p']) && $_GET['p'] != '') ? $_GET['p'] : 0;

require_once 'include/header.php';
?><style type="text/css">
<!--
body {
    background-image: url(images/star5.jpg);
}
.style1 {
    color: #CC0000;
    font-weight: bold;
}
-->
</style>
<table width="800" border="1" align="center" cellpadding="0"
cellspacing="0">
<tr><td colspan="3"><object
classid="clsid:D27CDB6E-AE6D-11cf-96B8-444553540000"
codebase="http://download.macromedia.com/pub/shockwave/cabs/flash/swflash.
cab#version=6,0,29,0" width="816" height="185">
    <param name="movie" value="top.swf">
    <param name="quality" value="high">
    <embed src="top.swf" quality="high"
pluginspage="http://www.macromedia.com/go/getflashplayer"
type="application/x-shockwave-flash" width="816" height="185"></embed>
</object></td>
</tr>
<tr bgcolor="#FFFFCC">
    <td>&nbsp;</td>
    <td><table width="100%" border="1">
    <tr>
        <td><a href="index.php"></a></td>
        <td><a href="VR/embedded.php" target="_blank"></a></td>
        <td><a href="product.php"></a></td>
      <td><a href="us.php"></a></td>
    </tr>
  </table></td><td>&nbsp;</td>
</tr>
<tr valign="top">
  <td width="150" height="400" bgcolor="#FFFFCC"
id="leftnav">&nbsp;</td>
  <td width="520" bgcolor="#CACAFF"><table width="100%"
height="100%" border="0">
    <tr>
      <td colspan="2"></td>
    </tr>
    <tr>
      <td width="27%">&nbsp;</td>
      <td width="73%">&nbsp;</td>
    </tr>
    <tr>
      <td colspan="2"><span class="style1">Thunderbird Hypermarket
</span></td>
    </tr>
    <tr>
      <td>&nbsp;</td>
      <td>&nbsp;</td>
    </tr>
    <tr>
      <td>Nature of business: </td>
      <td>An one-stop station for all your groceries need.</td>
    </tr>
    <tr>
      <td>&nbsp;</td>
      <td>&nbsp;</td>
    </tr>
    <tr>
      <td>Contact Person: </td>
      <td>Mr. Amir </td>
    </tr>
  </td>

```



```

        <td>Contact No.: </td>
        <td> 03-79676349</td>
    </tr>
    <tr>
        <td>Fax No.: </td>
        <td> 03-79579249</td>
    </tr>
</table></td>
<td width="130" bgcolor="#FFFFCC">&nbsp;</td>
</tr>
</table>
<?php
require_once 'include/footer.php';
?>

```

Figure 7-1: A PHP Page – index.php

VRML

For the VRML, it is using to generate the virtual environment. Below is the few sentences of VRML code.

```

#VRML V2.0 utf8
WorldInfo {
    title "Virtual Reality Application Hypermarket"
    info ["Author: Tang Wai Hung"]
}
DEF WALK_NAV NavigationInfo { headlight FALSE avatarSize [.15,
1.50, .5] type ["WALK", "ANY"]}
DEF FLY_NAV NavigationInfo { headlight FALSE avatarSize [.15,
1.50, .5] type ["FLY", "ANY"]}
Background {
    skyColor [0 0 1, 0.6 0.8 1, 1 1 1]
    skyAngle [1.5, 1.57]
    groundColor [0.7 0.8 0, 0.3 0.5 0]
    groundAngle [1.57]
}
Transform {
    translation 0 -.12 0

```

```

children Shape {
    appearance Appearance {material Material {emissiveColor 0.3
0.5 0.0 diffuseColor 0 0 0 }}
    geometry Box {size 200 .2 200}
}
}
DEF user1 Viewpoint {description "Start" position 6.85 2.10 95.95
orientation 0 1 0 -0.30}
ROUTE user1.isBound TO WALK_NAV.set_bind
DEF user2 Viewpoint {description "Book" position 1.75 2.10 27.35
orientation 0 1 0 -2.51}
ROUTE user2.isBound TO WALK_NAV.set_bind
DEF user3 Viewpoint {description "Apparel" position 3.85 1.60 11.55
orientation 0 1 0 -2.88}
ROUTE user3.isBound TO WALK_NAV.set_bind
DEF user4 Viewpoint {description "Daily Use" position 9.85 1.80
11.35 orientation 0 1 0 -5.52}
ROUTE user4.isBound TO WALK_NAV.set_bind
DEF user5 Viewpoint {description "Cosmetic" position 18.75 1.60
10.65 orientation 0 1 0 -0.00}
ROUTE user5.isBound TO WALK_NAV.set_bind
DEF user6 Viewpoint {description "Electronic" position 38.45 1.60
13.85 orientation 0 1 0 -5.86}
ROUTE user6.isBound TO WALK_NAV.set_bind
DEF user7 Viewpoint {description "Food & Beverage" position 34.65
2.10 31.55 orientation 0 1 0 -0.00}
ROUTE user7.isBound TO WALK_NAV.set_bind
DEF user8 Viewpoint {description "Furniture" position 21.45 1.60
41.65 orientation 0 1 0 -1.57}
ROUTE user8.isBound TO WALK_NAV.set_bind
DEF user9 Viewpoint {description "Top View" position 29.25 6.60
46.05 orientation 0 1 0 -2.86}
ROUTE user9.isBound TO WALK_NAV.set_bind
DEF user10 Viewpoint {description "Side View" position 25.95 1.60
45.95 orientation 0 1 0 -2.62}
ROUTE user10.isBound TO WALK_NAV.set_bind
DEF user11 Viewpoint {description "Front View" position 10.55 1.60
55.95 orientation 0 1 0 -0.00}
ROUTE user11.isBound TO WALK_NAV.set_bind

```

Figure 7-2: VRML Code

7.2.3.3 Scripting Language and CSS(Cascading Style Sheets)

CSS (*Cascading Style Sheets*) is also used to gain better control of the interface design.

```
#leftnav {  
    width: 150px;  
    font-size: 12px;  
    vertical-align: top;  
    font-size: 85%;  
}  
  
ul, ol {  
    font-family: Georgia, "Times New Roman", Times, serif;  
}  
  
#leftnav a {  
    /*padding: 3px;  
    display: block;  
    border: 1px dotted #CCC;  
    text-decoration: none;  
    line-height: 1em;  
    width: 150px /* */  
}  
  
#leftnav a:link, #leftnav a:visited {  
    color: #666;  
}  
  
#leftnav a:hover, #leftnav a:active {  
    color: #FFFFFF;  
    background-color: #6699CC;  
    border: 1px solid #000;  
}  
  
#leftnav ul {  
    /*padding: 0em;  
    margin-left: 0em;
```

```

margin-right: 0em;
list-style-type: none; /* */
}

#leftnav li {
    /**/margin: 0px 0px 6px 0px; /**/
}

#current a {
    color: #FFFFFF !important;
    /**/background-color: #999999 !important;
    border: 2px dotted #999 !important; /* */
}

#minicart {
    font-size: 10px;
}

.entryTable {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 12px;
    background-color: #DDDDDD;
}

.entryTableHeader {
    font-family: "Courier New", Courier, mono;
    font-size: 14px;
    color: #FFFFFF;
    background-color: #7F92A4;
    font-weight: bold;
    background-position: center;
}

.entryTable .label {
    background-color: #EFEFEF;
}

.entryTable .content {
    background-color: #FFFFFF;
}

```



```

.infoTable {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 12px;
    background-color: #DDDDDD;
}

.infoTableHeader {
    font-family: "Courier New", Courier, mono;
    font-size: 14px;
    color: #FFFFFF;
    background-color: #7F92A4;
    font-weight: bold;
    background-position: center;
}

.infoTable .label {
    background-color: #EFEFEF;
}

.infoTable .content {
    background-color: #FFFFFF;
}

.box {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 12px;
    border: 1px solid #336699;
}

.notice {
    color: #996600;
    font-weight: bold;
}

.addToCartButton {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 12px;
    color: #333333;
}

```

```
font-weight:bold;
border: 1px solid #336699;
background-color:#FFCC00;
}

#errorMessage {
color: #990000;
font-weight: bold;
}
```

Figure 7-3: CSS in VR Hypermarket

Chapter 8 - System Evaluation and Conclusion

8.1 Introduction

Evaluation is the ultimate phase of developing a system and an important phase before delivery the system to the end users. Evaluation was related to user environment, attitudes, information priorities and several other concerns that are to be considered carefully before effectiveness can be concluded. At all phases of the system approaches, evaluation is a process that occurs continuously, drawing on a variety of sources and information.

8.2 Problems Encountered and its Solutions

Problem with PHP coding

This is the first time that I use PHP to develop a dynamic web-page. So at the early stage of my development of VR Hypermarket, I found it hard to debug the code. Most of the code and algorithm I need to learn from the basic. Although there get some open sources embedded in my dynamic web-page, but I still need to read and understand what it means. Moreover, my coding needs to modify and add according to my requirement and what the web-site need. For the free sources of PHP code, this website helps me a lot - <http://www.phpfreaks.com/>

Problem with VRML coding

This is the code of the virtual environment that had been generated. For a big environment, there a get a thousand line of VRML code. Although the code is generated by using "Room Arranger", but I still need to modify the code by adding "Anchor Link", changing the scale, adjust the translation, scale as well as the coordinate of the objects. My application is about a hyper store so there get a

hundred links that go to the details of the goods, for this reason I and my partner need spent more time to write the “Anchor” link.

Problem with 3D navigation

The first problem that I encounter is during the navigation is – lag. Due to the heavy memory using by the 3D environment, the navigation become lag and slow. IT is hard for us during generate as well as testing the virtual environment. Because of the reason, I go to add more RAM to my pc and also add an external graphic card so my pc performance can support the virtual environment.

8.3 Evaluation by End User

As “Virtual Reality Application for Hypermarket” is proposed to make the application more interactive and different from traditional e-commerce web-site and the user can shop through the virtual application such as “add to cart” function The final stage of system development which is the system testing becomes critical and it needs feedbacks from all respective users in judging the correctness of these functionalities, precise data flow as well as user friendliness of the system’s interfaces.

Anyway, as the scope of “Virtual Reality Application for Hypermarket” is large, development was conducted with the objective to cover the scope briefly, which means that the whole system was developed quickly to have the overall structure and potential of the system but the system was not refined to show its full efficiency.

The overall feedback from the end users is good and “Virtual Reality Application for Hypermarket” is expected to serve the targeted group well after refining.

8.4 System Strengths

- “Add to cart” function

The function is let user can buy the things they want during shopping. There get a page that show the goods detail and price, user can get the information through the page. Besides that, the “add to cart” function also can let the user pay due to the embedded “Pay-Pal”. “Pay-Pal” is a 3rd-party paying method.

- Virtual Navigation

This can let user navigate the virtual environment by him or herself. They can straightly navigate the VR Hypermarket just clicking the mouse as well as the keyboard. The virtual application gets several “view-point”. The purpose of this “view-point” is making the navigation easier. It is more like guidance to the user. When the user click on the “view-point”, the user can straightly go to the place where they want.

- Future integration

“Virtual Reality Application for Hypermarket” is developed using PHP, which enable better integrity in the future.

- Support high volume of users

“Virtual Reality Application for Hypermarket” is deployed using the latest database from SQL, the MySql 4.1.7, which is the most powerful database in the market. This makes it ready to cope with large amount of user in the future.

8.5 System Constraints and Future Enhancements

As mentioned before, “Virtual Reality Application for Hypermarket” is still not fine enough to work at its full efficiency. Some refining work needs to be done to the system to increase its usability and reliability. The aspects to be refine and some suggestions to upgrade the system are as below:

- Strict data type checking

Check the input of user strictly using JavaScript to maintain the consistency of data stored and avoid error.

- Template for instructions

Templates for the test’s instructions which can be choose by user to choose the things.

- Better security and consideration of the online test

The online test can be improved to make it more secure from time to time to avoid fraud.

- Administrator management

Tool should be added to the system to enable the administrator manage the site well.

Appendix – User Manual

1.1 Introduction

Virtual Reality Application for Hypermarket (VR Hypermarket) that we developed was an offline system, but it can be online system. This system provides the information about the hypermarket department, the category of products, the item price, and stock amount. This manual is a guide to help user to using VR Hypermarket system effectively to achieve the goal.

This user manual is divided mainly into two parts, which are administrator part and user part. Administrator part is about how to use the hypermarket's administrator page, and the user part is about how to use hypermarket web page.

1.2 Administrator Section

1.2.1 Getting start

1. Begin using the system by login at the login page <http://localhost/plaincart/admin/login.php>. Using the username and the password during registration for login. If you do not have an account, please ask the administrator to add you at *Admin User* page on *Add User* link.



Figure 1: Login Page

2. After login successfully, you need to choose a menu from the left navigation to get started.

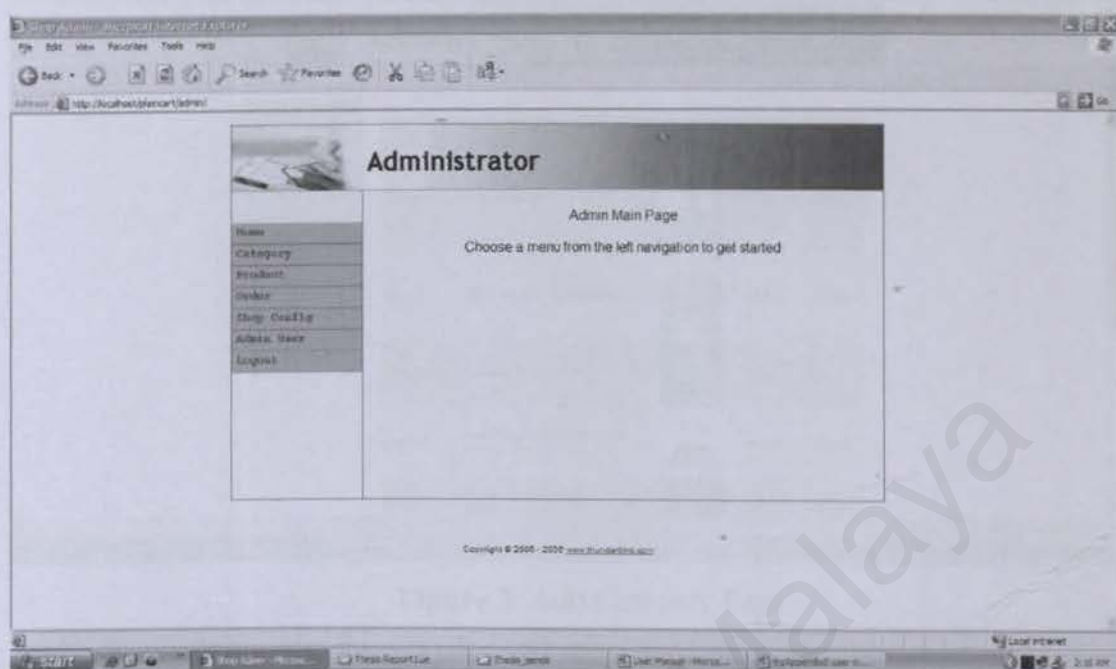


Figure 2: Home

3. Then, you can manage the hypermarket's stocks, admin users, or hypermarket's business configuration by update, edit or delete the data at administrator's page which directly deal with the database's data.

IMPORTANT: please click '*Logout*' at menu before close the web page for security purpose.

1.2.2 Category Management

1.2.2.1 Add New Category

1. Click on the '*Category*' button at the menu from the left navigation.

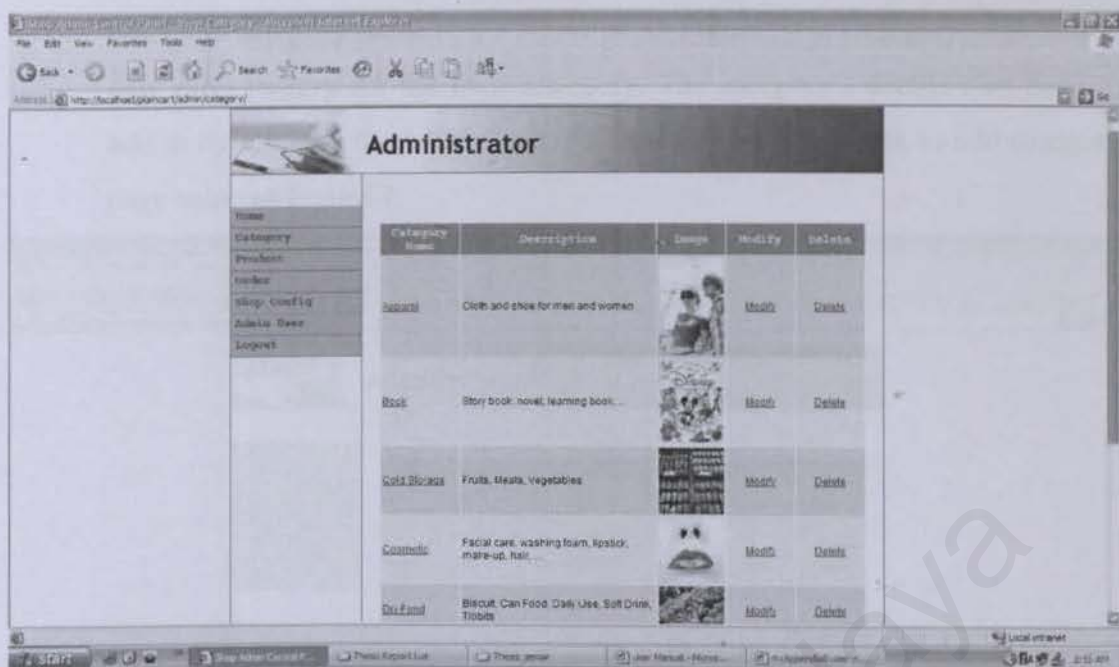


Figure 3: Add Category Page

2. A page as in Figure 3 will appear. Click 'Add Category' link at below to add the new category.
3. After fill all the new category details (Figure 4), click 'Add Category' button to add the category and the data will automatic add into database.

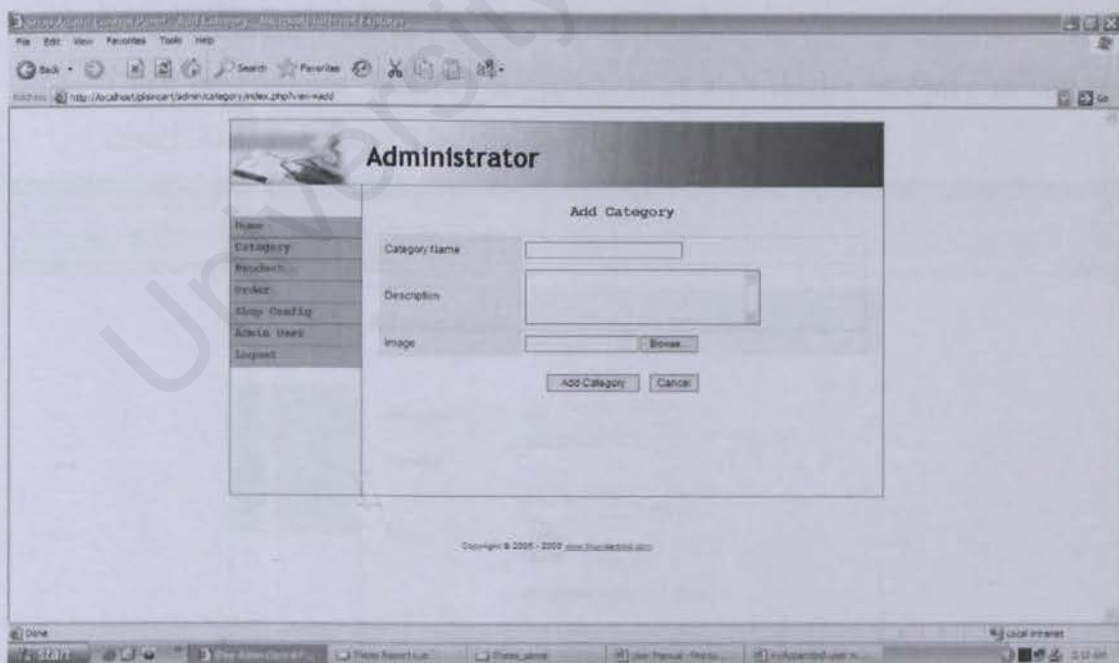


Figure 4: Add Category Detail

- Click the category name (e.g.: 'Apparel' at Figure 3) at Category page to add new sub category for the main category. The category's details also need to add in by clicking the 'Add Category' button which will link to add category page same as Figure 4.

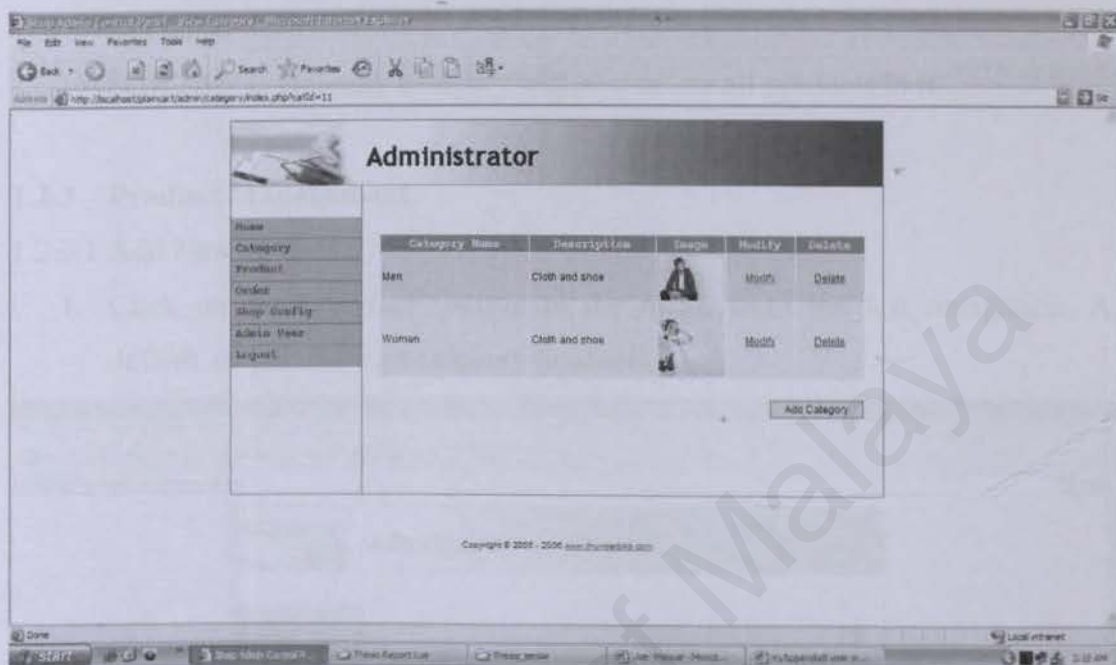


Figure 5: Add Sub Category

1.2.2.2 Modify Category Detail

- Click the 'Modify' link (as in Figure 3) of a particular category to edit its detail. Just click 'Save Modification' button after edit.



Figure 6: Modify Category Detail

1.2.2.3 Delete Category

1. Click the '*Delete*' link (as in Figure 3) of a particular category to delete category.

IMPORTANT: Deleting category will also delete all products in it

1.2.3 Product Management

1.2.3.1 Add New Product

1. Click on the '*Product*' button at the menu from the left navigation. As default, it will show all category products.

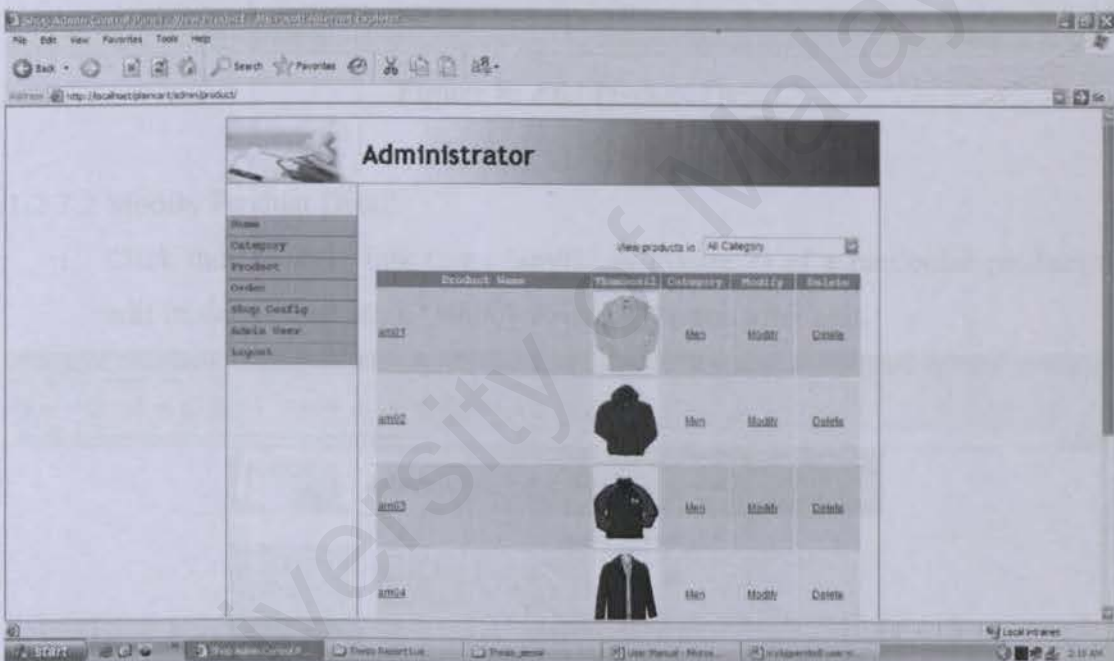


Figure 7: Add Product Page

2. A page as in Figure 7 will appear. Click '*Add Product*' link at below to add the new product.
3. After fill all the new product details (Figure 8), click '*Add Product*' button to add the product and the data will automatic add into database.

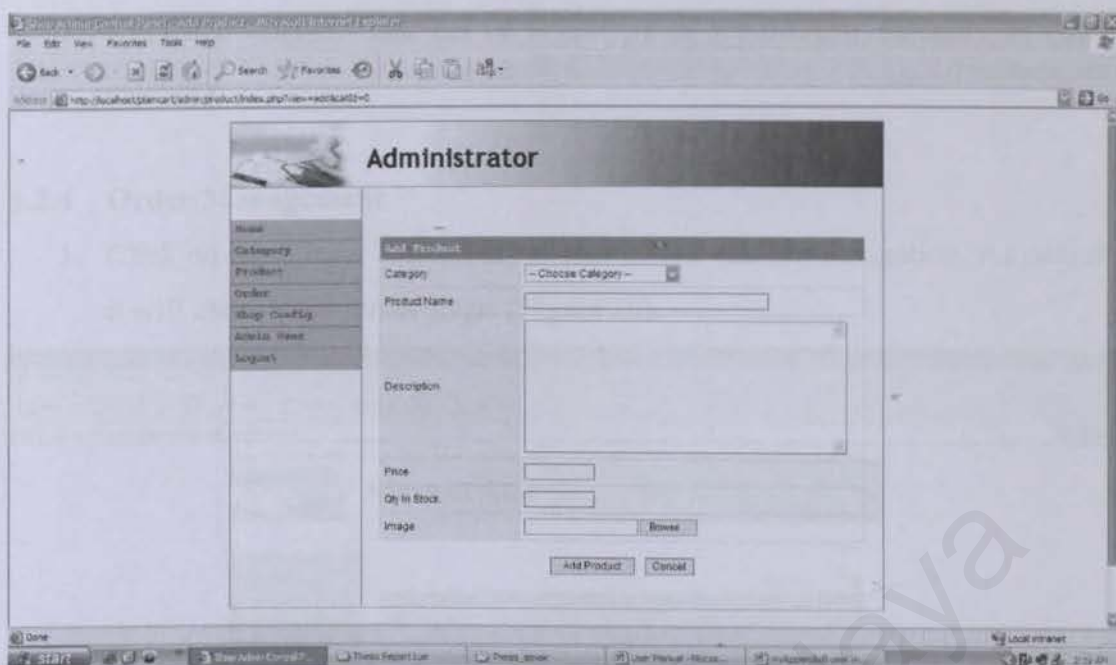


Figure 8: Add Product Detail

1.2.3.2 Modify Product Detail

1. Click the 'Modify' link (e.g.: 'am01' in Figure 7) of a particular product to edit its detail. Just click 'Modify Product' button after edit.

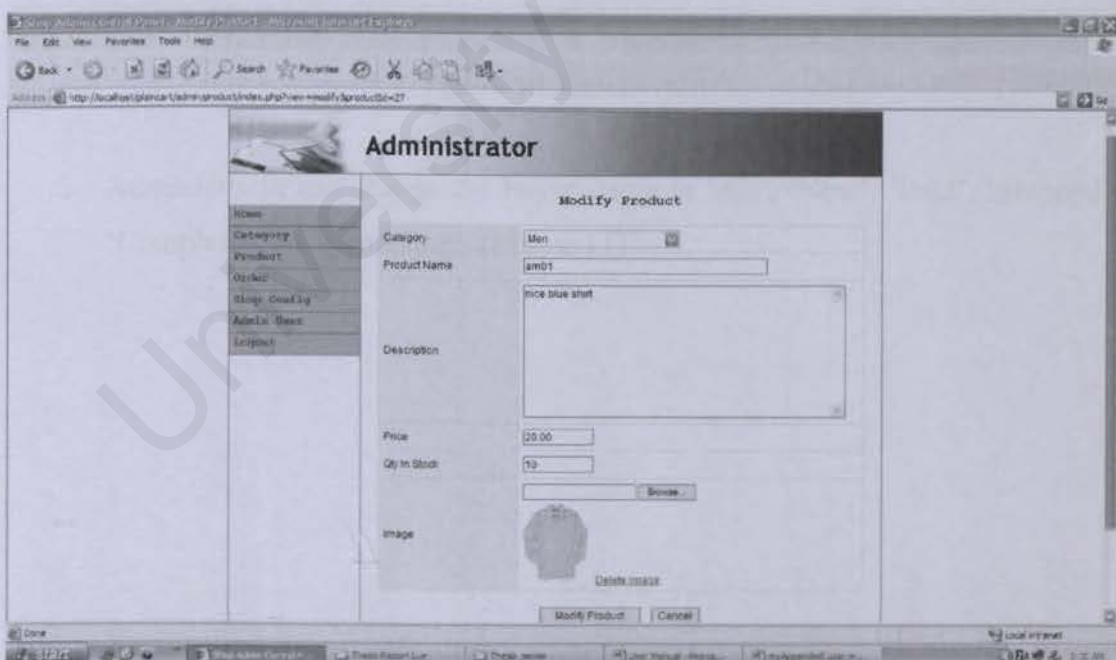


Figure 9: Modify Product Detail

1.2.3.3 Delete Product

1. Click the 'Delete' link (as in Figure 3) of a particular category to delete category.

1.2.4 Order Management

1. Click on the 'Order' button at the menu from the left navigation. As default, it will show 'paid' order page. (Figure 10)

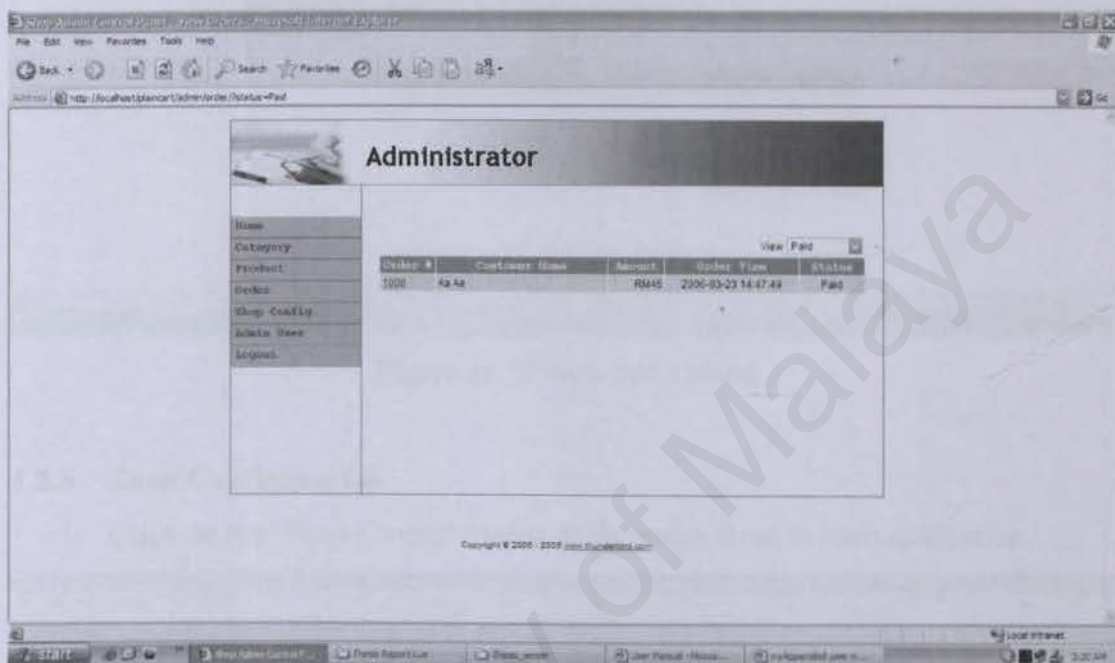


Figure 10: Order - Paid

2. Administrator can change the buyer status to 'All', 'New', 'Paid', 'Shipped', 'Completed' or 'Cancelled'. (Figure 11)

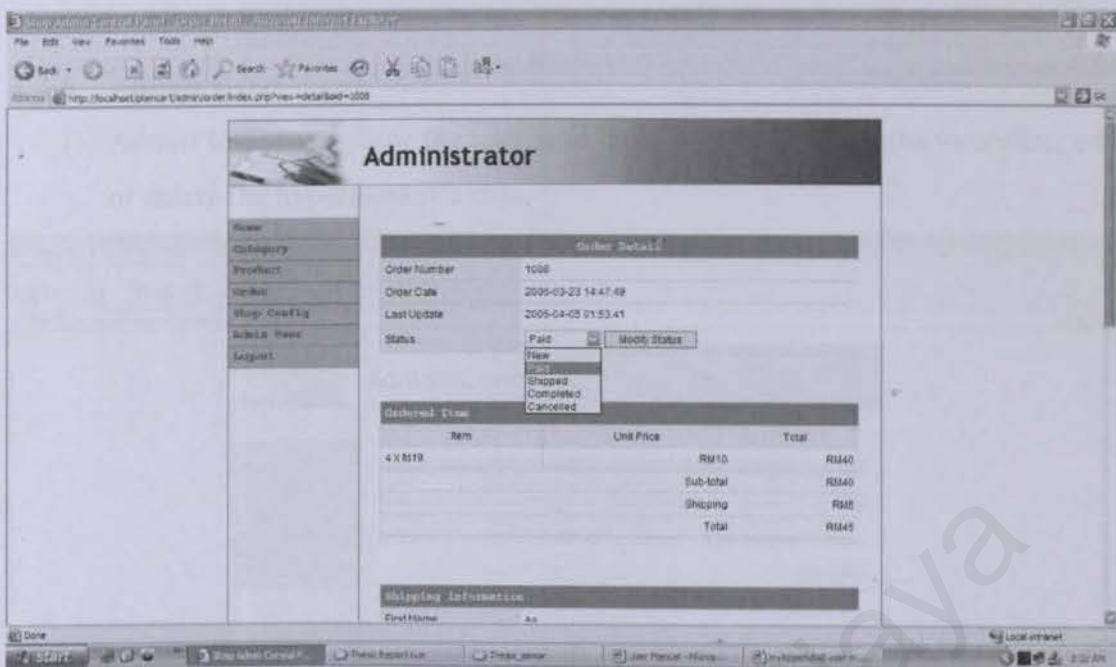


Figure 11: Change Order Status

1.2.5 Shop Configuration

1. Click on the 'Shop Config' button at the menu from the left navigation.



Figure 12: Hypermarket Detail Configuration

2. The hypermarket details (name, address, and email), currency and the shipping cost can be modifying at here.

1.2.6 Admin User

1. Admin User page show the user who have administrator status to update, edit or delete the hypermarket's data.

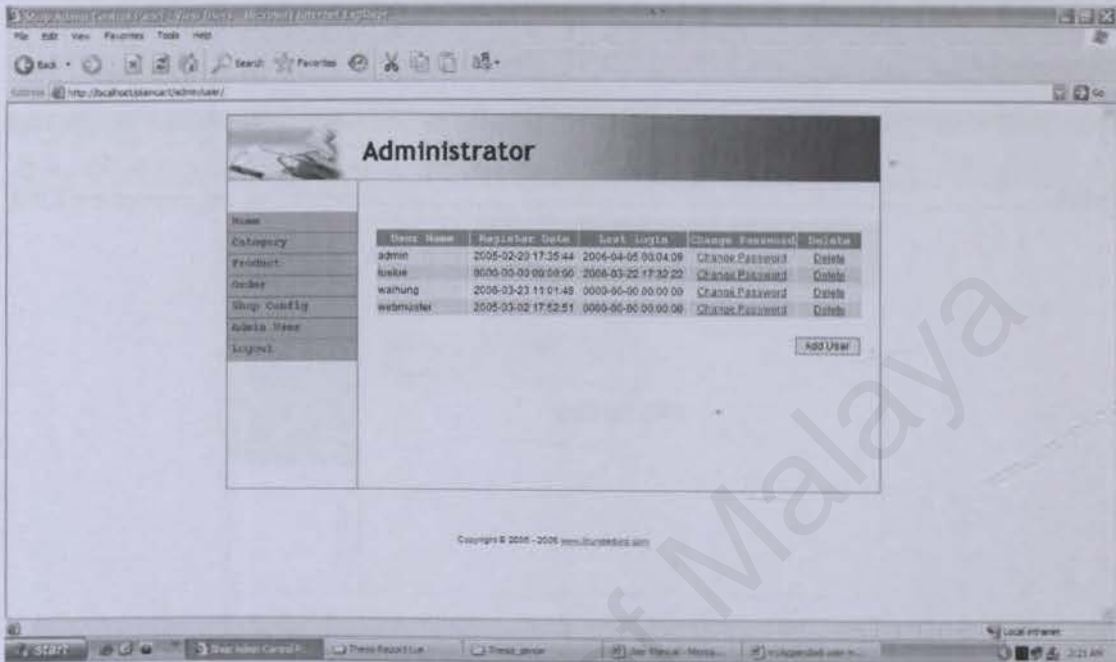


Figure 13: Admin User

1.2.6.1 Add Admin User

1. Click 'Add User' at below the page (Figure 13).
2. Fill in the username and password, and then click 'Add User' button.



Figure 14: Add Admin User

1.2.6.2 Change Password

1. Click the '*Change Password*' of a particular user (Figure 13) to edit its password. Just enter your new password and click '*Modify User*' button to save (Figure 15).

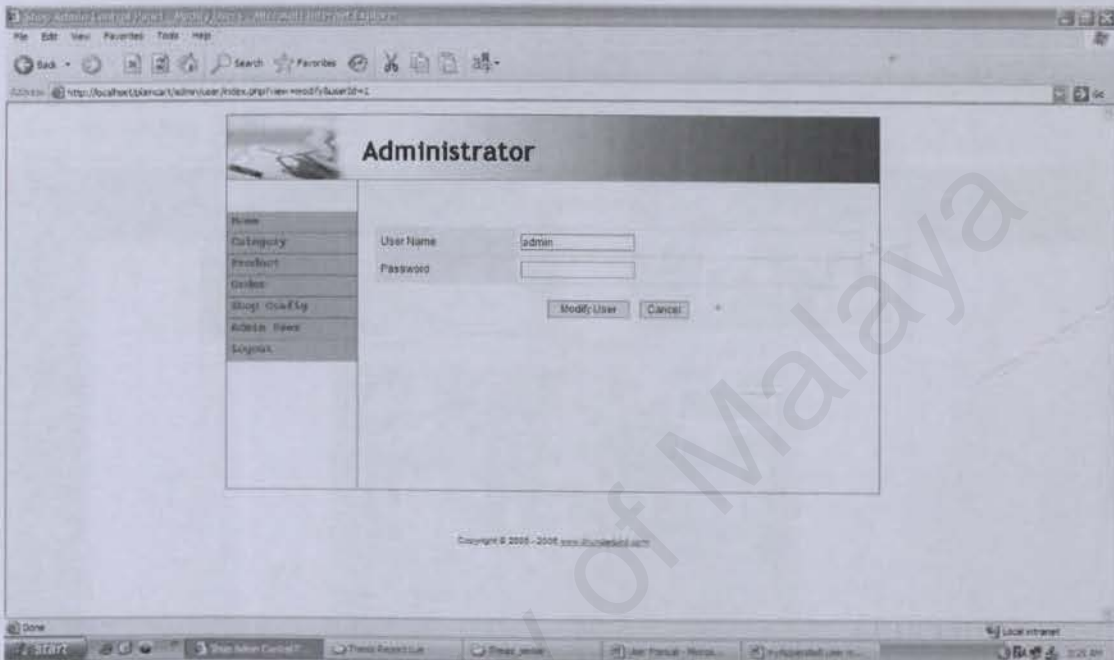


Figure 15: Change Password

1.2.6.3 Delete User

1. Just click the '*Delete*' button beside the particular user for delete the user (Figure 13).

1.3 User Section

1. The user login address is different with the administrator login. The hypermarket home main page is <http://localhost/plaincart/index.php>.
2. User can browse, search, survey product detail and buy the product inside the hypermarket main page. But all the normal user is cannot edit the hypermarket's database data.



Figure 16: Hypermarket Main Page

1.3.1 Home Page

1. The main page of the hypermarket site is about the detail of the hypermarket and the information of contact person. (Figure 16)
2. The flash banner just can found in main page, the other page is just a hypermarket's logo.

1.3.2 Virtual Tour Page

1. User can browse and walk around the hypermarket virtual environment. (Figure 17)
2. When the user click the product inside the hypermarket, it will directly link user to the product 'Add To Cart' page, or some item (e.g.: vegetables) is link user to it product page, so user can choose what they want. (Figure 18)

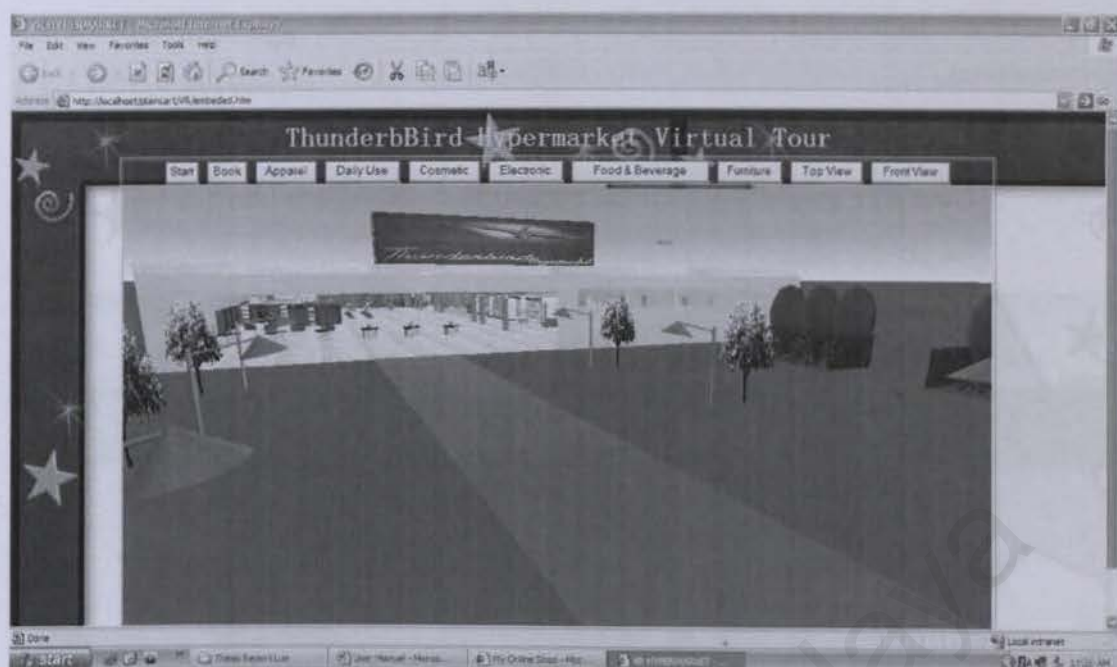


Figure 17: Hypermarket Main Page

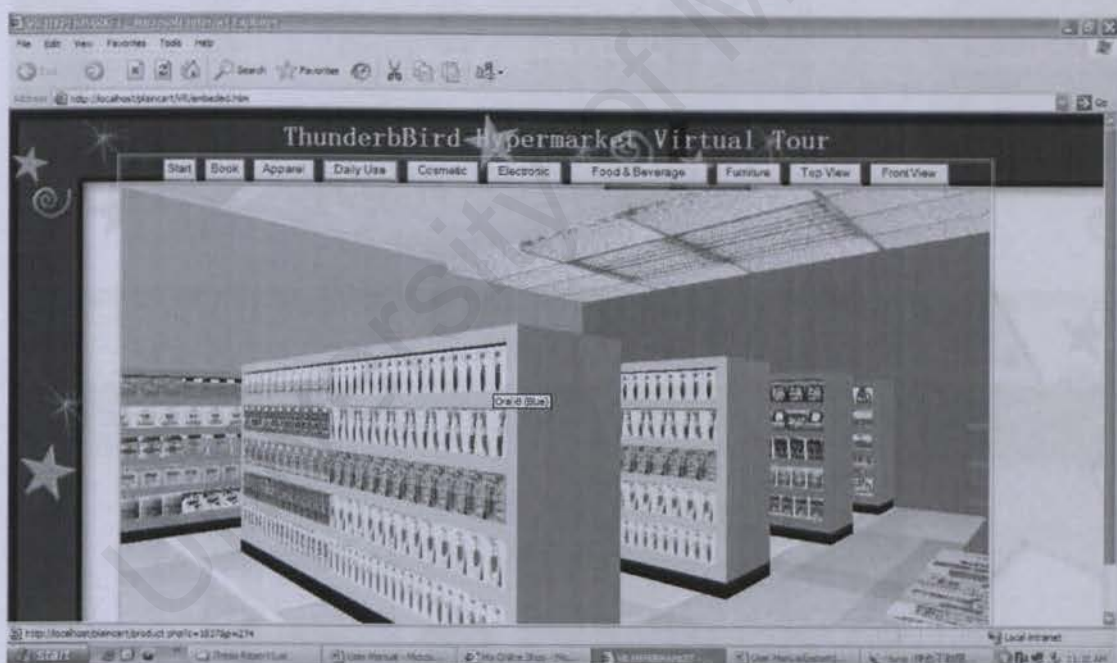


Figure 18: Choose Product at VR Environment

3. For faster navigation, user can choose the link at above to directly bring user to the department.

1.3.3 Product Page

1.3.3.1 Choose Product

1. Just click the product and it will show the product detail. (Figure 19)
2. User can add the product to cart first before confirm buy. (Figure 20)



Figure 19: Choose Product at Website



Figure 20: Choose Product for Add To Cart

1.3.3.2 Shopping Cart

1. Click 'Go To Shopping Cart' hyperlink (at right of the page as Figure 20) to go to shopping cart page.
2. User can update the quantity of the particular product, or delete the product by click the 'Delete' button. (Figure 21)

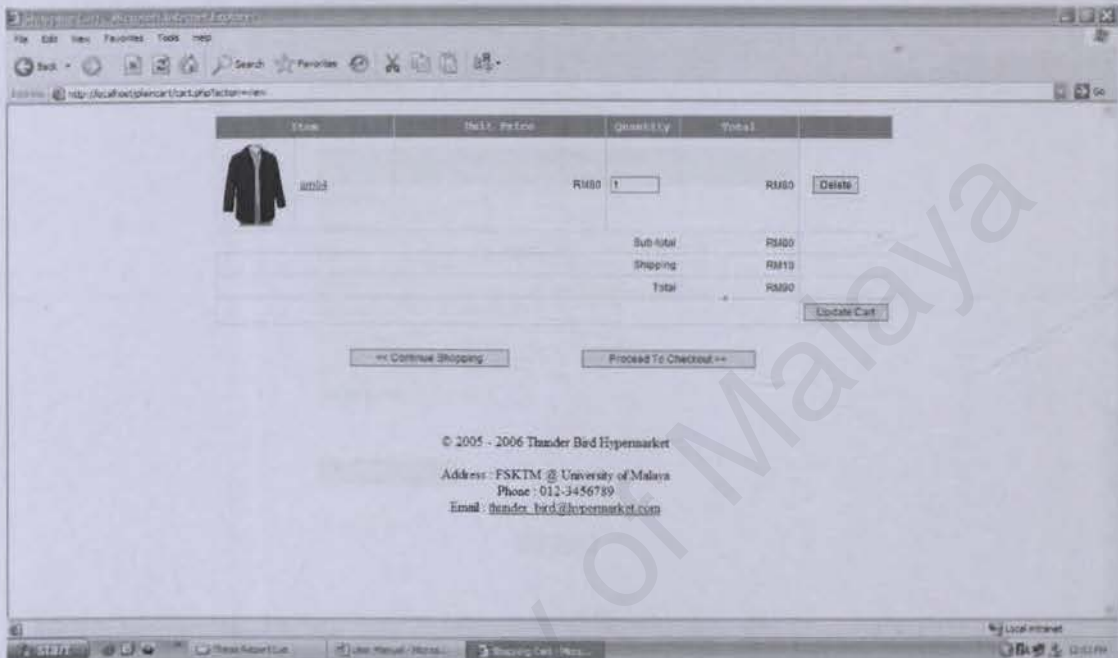


Figure 21: Update Shopping Cart

3. Then (as Figure 22), step 1, it will ask user to fill in their details, and enter shipping and payment information before confirm transaction.
4. Step 2 is confirmation of the user order. (Figure 23)
5. After click 'Confirm Order' button, the transaction is success. (Figure 24)

Step 1 Of 3: Enter Shipping And Payment Information

Shipping Information	
First Name	Louis
Last Name	Cheng
Address1	22, Jin 19/28, Selangor 18
Address2	
Phone Number	012-5551888
Province / State	Selangor
City	Petaling Jaya
Postal / Zip Code	45300

Payment Information	
<input checked="" type="checkbox"/> Same as shipping information	
First Name	Louis
Last Name	Cheng
Address1	22, Jin 19/28, Selangor 18
Address2	
Phone Number	012-5551888
Province / State	Selangor
City	Petaling Jaya
Postal / Zip Code	45300

Payment Method: ☐ Paypal ☒ Cash on Delivery

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 Address: FSKTM @ University of Malaya
 Phone: 012-3456789
 Email: thunder_bird@hypermarket.com

Figure 22: Enter Shipping and Payment Information

Internet Explorer - Step 2 of 3 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites

Address http://localhost/placement/checkout.php/step=2

Step 2 Of 3 : Confirm Order

Order Summary			
Item	Unit Price	Total	
1 x item4		RM90	RM90
		Sub-total	RM90
		Shipping	RM10
		Total	RM100

Shipping Information	
First Name	Louis
Last Name	Cheng
Address1	29, Jin 1928, Seksyen 19
Address2	
Phone Number	012-5551888
Province / State	Selangor
City	Petaling Jaya
Postal Code	46300

Payment Information	
First Name	Louis
Last Name	Cheng
Address1	29, Jin 1928, Seksyen 19
Address2	
Phone Number	012-5551888
Province / State	Selangor
City	Petaling Jaya
Postal Code	46300

Payment Method: ☒ Cash on Delivery

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Address: FSKTM @ University of Malaysia
Phone: 012-3456789
Email: thunder_bird@hypermarket.com

Done

Start Open Project List Open Manual Home Database Step 2 of 3 Local intranet 12:31 PM

Figure 23: Confirm Order

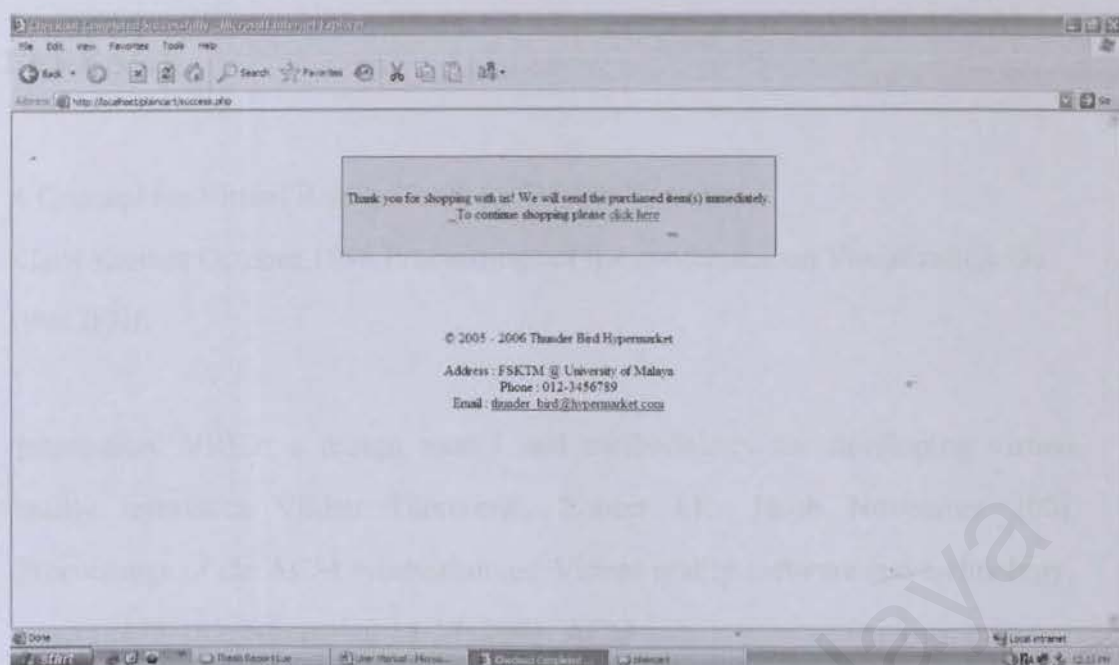


Figure 24: Success Shopping

1.3.4 About Us Page

1. Just show the hypermarket stuff information. (Figure 25)

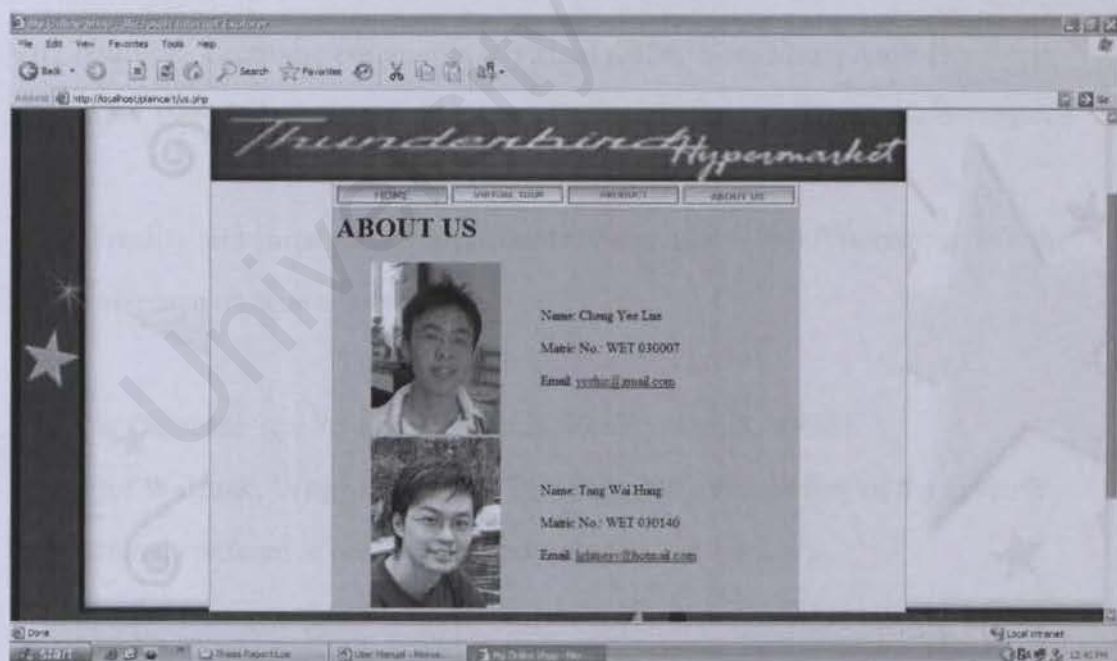


Figure 25: About Us

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